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THE Festivus

Vol. 55(3) August 2023

An endemic *Fasciolaria* from Yucatan

Fossil ovulids from Indonesia

A new *Neodilatilabrum* from Japan

New cone shells from Australia and Mozambique

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Live specimen of *Voluta musica* Linnaeus, 1758, *in situ*, off Union Island, night dive at 40 feet.. (Photo courtesy of Charles Rawling) (Cover artistic credit: Rex Stilwill).

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Volume: 55 THE FESTIVUS ISSUE 3

TABLE OF CONTENTS

Peer Reviewed Articles

- A New Species of Fossil *Pseudosimnia* (Gastropoda: Ovulidae) from the Miocene of West Java, Indonesia 154
  By Alain Clezard & Matteo Dovesi
- A New *Fasciolaria* (Fasciolariidae: Fasciolariinae) from the Yucatan Peninsula of Mexico 165
  By David P. Berschauer & Edwards J. Petuch
- A New Endemic Species of *Miliariconus* Tucker & Tenorio, 2009 (Gastropoda: Conidae) from Western Australia 170
  By Stephen J. Maxwell & David P. Berschauer
- A Review of *Neodilatilabrum* Dekkers, 2008 (Mollusca: Neostromboidae: Strombidae) Resulting in a New Species from Japan 178
  By Stephen J. Maxwell
- Description of a New Species of *Darioconus* from Mozambique 199
  By Roy Aiken
- A New Genus and Species of Chiton from the Aleutian Islands 205
  By Roger Clark

Club News 210

Articles of General Interest

- Modeling Mollusks 212
  By Wes Farmer
- Clapping Clams: *Limaria pacifica* in its Happy Place 214
  By Hans Bertsch
- Range Extension and Size Range of *Terebra pedroana* Dall, 1908 217
  By Roger A. Evans
- Variability in *Gradiconus maya* Petuch and Sargent, 2011 220
  By Felix D. Salas
- The Passing of a Best Friend - Paul Kanner 222
  By Marty Beals
- Paul Herman Kanner 1934-2023 224
  By Harry Bedell

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Volume: 55 THE FESTIVUS ISSUE 3

A New Species of Fossil *Pseudosimnia* (Gastropoda: Ovulidae) from the Miocene of West Java, Indonesia

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ABSTRACT A new species of Ovulidae Schilder, 1968, *Pseudosimnia javanensis* n. sp., is described from Miocene formations in the hills south of Tasikmalaya, West Java, Indonesia. The general appearance of the new taxon shows a combination of characters that distinguish it from any other living species of *Pseudosimnia* Schilder, 1925. One subspecies is also described, *Pseudosimnia javanensis elongata* n. ssp.

KEY WORDS Gastropoda, Ovulidae, *Pseudosimnia*, *P. javanensis*, *P. javanensis elongata*, Miocene, Tasikmalaya, Java, Indonesia

INTRODUCTION

Ovulidae Schilder, 1968, also commonly called "allied cowries" or "false cowries" are, as their name suggests, gastropod mollusks closely related to Cypraeidae Rafinesque, 1815, which is one of the best-documented families of the animal kingdom (Lorenz & Fehse 2009). If Ovulidae have, for some genera at least, a cowry-like shell, one of their common characteristics is not to have columellar teeth. For the rest, they have a smooth or finely striated shell and, in the vast majority of cases, an internalized spire at the posterior end. Whereas knowledge of the animal often provides valuable information for identifying species within a given genus, a close examination of the shell is generally sufficient, to attribute a precise genus to Ovulidae found dead. Although the Ovulidae have relatively fragile shells, thus subject to rapid disintegration upon death of the animal (Lorenz & Fehse 2009), a number of fossil species are known from this family.

In Europe, species belonging to genera still living today have been found in deposits dating from the Ypresian (Lower Eocene): *Sandalia* Cate, 1973, to the Zanclean (Lower Pliocene): *Neosimnia* Fischer, 1884, through the Rupelian (Oligocene): *Neosimnia* Fischer, 1884, the Langhian and Serravalian (Middle Miocene): *Neosimnia* Fischer, 1884 and *Simnialena* Cate, 1973. Recently, in the West Java region of Indonesia, south of the city of Tasikmalaya, a considerable number of marine mollusk specimens have been found, in particular representatives of the family Cypraeidae, Strombidae Rafinesque, 1815, Melongenidae Gill, 1871, Terebridae Mörch, 1852, Marginellidae Fleming, 1828, and more rarely of the family Ovulidae Fleming, 1822. Some genera of the aforementioned families are not clearly assignable due to the deformation of some shells from crushing or because they are probably extinct genera that remain to be described.

Of all the genera observed, the specimens belonging to the genus Ovulidae are considerably fewer, either because they are

ISSN 0738-9388

much less represented in these deposits, or simply because the specimens are much smaller and less spectacular, therefore of less interest to local miners. However, 28 fossil specimens of Ovulidae have been examined and found to have outline, terminal, aperture and fossula features not attributable to previously described species. The repeatability and constancy of the characteristics of these shells are typical of the genus *Pseudosimnia* Schilder, 1925, but with notable differences with respect to contemporary species known in the same region or any other part of the world. We compare them with other species of *Pseudosimnia*, especially *Pseudosimnia jeanae* (Cate, 1973) to which it is the most closely related in appearance, to highlight similarities and differences, and conclude that there are no living species of *Pseudosimnia* with analogous traits. We are only aware of a few photos of fossil Ovulidae from Java, published in Dharma (2005). Among them, one (Fig. 23, Plate 140, page 351, Dharma, 2005) corresponds exactly to the species introduced here. However, on the one hand, the taxon had still not been described, and on the other hand, it was attributed to the genus *Margovula* Cate, 1973. Therefore, we describe this species as new to science, named *Pseudosimnia javanensis* with the related subspecies *elongata*.

ABBREVIATIONS

ACC Alain Clezard collection (Epinal, France)
MDC Matteo Dovesi collection (Bologna, Italia)
IGF Firenze Museum, Florence, Italia

MATERIAL EXAMINED

Twenty-six complete fossil shells and two fossils in matrix of *Pseudosimnia javanensis* were examined, all from the southern area of Tasikmalaya City, West Java, Indonesia, found between 2 and 4 meters deep in the subsoil of Miocene sediments when they were collected.

SYSTEMATICS

Class	Gastropoda Cuvier, 1795
Subclass	Caenogastropoda Cox, 1960
Order	Littorinimorpha Golikov & Starobogatov, 1975
Superfamily	Cypraeoidea Rafinesque, 1815
Family	Ovulidae Fleming, 1822
Subfamily	Prionovolvinae Fehse, 2007
Genus	*Pseudosimnia* Schilder, 1927

Pseudosimnia javanensis new species †
Celzard and Dovesi, 2023
(Plates 1-3)

Description. Shell rather small, pyriform, smooth over the entire surface; dorsum glossy, with a hammered-like surface; anterior terminal elongated, broad and spatulate, rounded, slightly oblique; posterior terminal protruding, slightly twisted; ventrum bulbous, with a slightly marked dorsal keel, giving the shell a somewhat rhomboidal outline; labrum rounded, calloused and smooth; aperture narrow in consideration of the width of the shell, hardly widening anteriorly; fossula shallow; inner adaxial carinal ridge absent; funiculum slightly marked, smooth and almost without relief, merging with the left part of the anal canal.

Type Material. Holotype IGF105105, length 11.5 mm, width 6.9 mm, preserved in the Museo di Scienze Naturali dell'Università di Firenze (Firenze, Italia) (Plate 1). *Pseudosimnia javanensis* paratypes in mineral matrix (Plate 2) A= length 11.6 mm, (MDC); B, length 12.8 mm, (ACC); Other *P. javanensis* paratypes (Plate 3): A= length 14.9 mm, width 9.2 mm, (MDC); B= length 15.8 mm, width 9.3 mm, (MDC); C= length 16.2 mm, width 9.4 mm, (MDC); D= length 14.0 mm, width 7.9 mm, (MDC); E= length 11.3 mm, width 6.7 mm, (MDC); F= length 12.0 mm, width 7.3 mm, (MDC); G= length 13.4 mm, width 7.9 mm, (ACC);

ISSN 0738-9388

H= length 17.9 mm, width 10.9 mm, (ACC);
I= length 13.9 mm, width 8.1 mm, (ACC);
J= length 12.2 mm, width 7.2 mm, (MDC);
K= length 9.3 mm, width 5.5 mm, (ACC).

Plate 1 shows the holotype, Plate 2 shows two fossils in two different types of matrix (compressed sand and rock), while 11 paratypes are presented in Plate 3. For all the material examined, no apparent evidence of concentric striations could be seen near the terminal collars, unlike what is more often seen in modern *Pseudosimnia*.

Pseudosimnia javanensis elongata new subspecies †
Celzard and Dovesi, 2023
(Plate 4)

Description. Shell described here as subspecies of *Pseudosimnia javanensis*, conforming to overall shell characters of nominate subspecies; shell rhomboid in shape, with more elongated outline; body whorl less inflated than that of nominate subspecies; aperture very narrow, with width being half that of nominate subspecies.

Type Material. Holotype IGF105162, length 18.3 mm, width 10.1 mm, shown on Plate 4 Figure B, preserved in the Museo di Scienze Naturali dell'Università di Firenze (Firenze, Italia). *P. javanensis elongata* paratypes (Plate 4):
A= length 15.6 mm, width 8.1 mm, (MDC);
C= length 13.8 mm, width 7.6 mm, (MDC);
D= length 11.5 mm, width 6.5 mm, (MDC);
E= length 11.2 mm, width 6.2 mm, (ACC);
F= length 13.8 mm, width 7.7 mm, (ACC);
G= length 12.1 mm, width 7.1 mm, (ACC);
H= length 13.6 mm, width 7.8 mm, (ACC);
I= length 17.0 mm, width 9.3 mm, (ACC);
J= length 14.3 mm, width 7.6 mm, (ACC);
K= length 15.0 mm, width 8.4 mm, (ACC);
L= length 15.6 mm, width 8.6 mm, (ACC);
M= length 17.5 mm, width 9.0 mm, (ACC);
N= length 12.7 mm, width 6.9 mm, (ACC).

Type Locality and Stratigraphic Range. The physiography of West Java has geological features consisting of flood plains, folded hills and volcanoes. Based on physiography, van Bemmelen (1949) divided West Java into four zones: Jakarta Zone, Bogor Zone, Bandung Zone, Southern Mountains Zone. South of Tasikmalaya, the area of discovery of the presented material in the southern mountains, is a plateau with a Miocene sedimentary rock surface, as shown in the papers by Sampurno, 1976 (Figure 1). This area, in several places, has a deeply incised surface so that it is no longer a plateau but consists of hills with deep fissures and landslides where many fossils have been found.

Etymology. The species presented is called *javanensis*, in obvious reference to its geographical origin, while the name of the subspecies *elongata* speaks for itself.

ISSN 0738-9388

Figure 1. Map of West Java (Sampurno, 1976). The red point indicates the site of origin.

DISCUSSION

The present new species and subspecies unquestionably belong to the genus *Pseudosimina*. Indeed, according to Cate (1973), the shells of *Pseudosimina* are fairly small, pyriform, inflated, with unusually broad projecting terminals and, for the most part, lacking significant dorsal and ventral incised striation. The shells have an anterior terminal broadly projecting, a funiculum that forms the left wall of the anal canal and a cowry-like terminal ridge (Lorenz & Fehse 2009). Such a definition agrees very well with the former description of *P. javanensis*, although the labrum is completely smooth, while Lorenz & Fehse (2009) include in their diagnosis of *Pseudosimnia* that the labrum is distinctly denticulate along the inner margin. However, the living species *P. juanjosensii* (Pérez & Gómez 1987) also presents an almost smooth inner margin.

P. javanensis and *P. javanensis elongata* are, from the 28 specimens examined, surprisingly variable in size and shape. Indeed, in addition to very small specimens, which nevertheless do not show any juvenile character, there are specimens of quite remarkable size for the genus *Pseudosimnia*, since several of them exceed 17 mm in length. The vast majority of living *Pseudosimnia* are only slightly larger

ISSN 0738-9388

than 10 mm in length, on average. The larger specimens of *P. javanensis* are oval pyriform, inflated, and with a smoother surface without losing the hammered-like character. The slightly smaller specimens, around 15 mm, are rather oval-rhomboid roundly, and have a clearly hammered-like surface. However, it is possible to make a series of shells in which all the intermediate variations exist between extreme specimens, either particularly globular and bulging, or particularly elongated and rhomboid, and this at the same time whether they are larger or on the contrary smaller.

Figure 2 shows the length, width and height measurements of each specimen examined, and the aspect ratios length/width (L/W) and length/height (L/H) are calculated and plotted in Figure 3. It is thus possible to distinguish the variability *P. javanensis* n. sp. from that of the more tapered *P. javanensis elongata* n. ssp. with a wider radius of curvature.

A comparative survey can be made with the living species related to *P. javanensis* to be convinced that the latter is definitely different from any other living species. The most morphologically related species is *P. jeanae* (Cate, 1973), which has a wide distribution area, from Japan to New Caledonia, passing through China and the Philippines. However, viewing a large number of specimens did not allow the authors to identify any example as rostrate and/or with a terminal anterior as developed and an outer lip as broad and calloused as those which systematically characterize *P. javanensis*. Two species close to *P. jeanae*, and with which they are sometimes confused, are *P. pyrulina* (Adams, 1855) and *P. shikamai* (Cate, 1973), with rather similar distribution ranges. However, if *P. pyrulina* is generally larger than *P. jeanae*, its shell is also thinner and lighter and its aperture wider, which is not consistent with the fossils discussed here. As for *P. shikamai*, it has a distinctly striated dorsum, which is absolutely not the case here. *P. diaphana* (Liltved, 1987), reported from Japan and Taiwan, is more rhombohedral, similar to some forms of *P. javanensis*, but has also the dorsum entirely striated. *P. wieseorum* (Lorenz, 1985) is an East African species similar to *P. pyrulina* and *P. jeanae*, but again with a thinner shell and a much larger aperture than *P. javanensis*.

The European and Northwest African species *P. carnea* (Poiret, 1789) is stockier and rarely rostrate, whereas this is a systematic character of *P. javanensis*. The species *P. angusta* (Celzard, 2017) from the same region although more present in the near Atlantic area, and of which a few rare specimens are sometimes found within populations of *P. carnea*, has many similarities with *P. javanensis elongata* in terms of rostration, general outline and variability. However, *P. angusta* has a thinner and lighter shell, a surface lacking the hammered-like character but finely striated near the terminal collars, and a prominent funiculum. Also, in terms of rostration and contour, rather pyriform sometimes inflated, sometimes more rhomboid, some specimens of *P. javanensis* recall the very rare species *P. vanhyningi* (Smith, 1940), known from the tropical waters of the Western Atlantic, but the strong dentition of the labrum excludes any further comparison. In the end, no matter which living species of *Pseudosimnia* is considered, there is always at least one feature contradicted by examination of the available fossil record, and none of these contemporary species further combine lack of denticulation on the labrum, narrowness of the aperture, and insignificant or absent funiculum.

We can also specify that, by placing the specimens under a UV lamp, either at a wavelength of 365 nm or 254 nm, no residual color pattern could be demonstrated. Modern *Pseudosimnia* are species with generally

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uniform colorations in the pastel range, and sometimes with a paler band at mid-dorsum. They also show the greatest color contrast at the tips and around the margin, often with a distinct yellow suture line along the labrum and the terminal collars. Living *Pseudosimnia* species with a thickened lip, such as *P. carnea*, *P. pyrulina*, *P. jeanae*, *P. shikamai*, *P. diaphana*, and *P. wieseorum*, typically exhibit this yellow suture line. However, nothing like this could be observed under ultraviolet light on *P. javanensis* or *P. javanensis elongata*.

The set of morphological characteristics, thick but completely smooth labrum, indistinct funiculum, extremely narrow aperture, total absence of striae on the terminal collars, and significant rostration, not attributable to other known *Pseudosimnia*, characterize the new species presented, with its relative subspecies, originating from the Miocene of the southern areas of Tasikmalaya in West Java, Indonesia.

ACKNOWLEDGEMENTS

The authors thank Stefano Dominici (Head of the Geology and Paleontology section, Natural History Museum, University of Florence, Italy) for discussions on taxonomy and geology.

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Pseudosimnia javanensis												
	Hol	**P3-A**	**P3-B**	**P3-C**	**P3-D**	**P3-E**	**P3-F**	**P3-G**	**P3-H**	**P3-I**	**P3-J**	**P3-K**
Length	11.5	14.9	15.8	16.2	14.0	11.3	12.0	13.4	17.9	13.9	12.2	9.3
Width	6.9	9.2	9.3	9.4	7.9	6.7	7.3	7.9	10.9	8.1	7.2	5.5
Height	5.5	7.7	7.8	7.9	7.2	5.5	6.2	6.7	9.1	6.7	5.9	4.5
L/W	1.65	1.63	1.70	1.71	1.76	1.69	1.64	1.69	1.65	1.70	1.68	1.68
L/H	2.07	1.94	2.03	2.03	1.94	2.05	1.94	2.00	1.97	2.05	2.05	2.07

Pseudosimnia javanensis elongata														
	P4-A	**P4-B**	**P4-C**	**P4-D**	**P4-E**	**P4-F**	**P4-G**	**P4-H**	**P4-I**	**P4-J**	**P4-K**	**P4-L**	**P4-M**	**P4-N**
Length	15.6	18.3	13.8	11.5	11.2	13.8	12.1	13.6	17.0	14.3	15.0	15.6	17.5	12.7
Width	8.1	10.1	7.6	6.5	6.2	7.7	7.1	7.8	9.3	7.6	8.4	8.6	9.0	6.9
Height	6.9	8.0	6.4	5.4	5.0	5.9	5.3	6.3	8.1	6.7	6.8	6.7	7.9	5.5
L/W	1.92	1.82	1.83	1.79	1.81	1.81	1.72	1.76	1.82	1.88	1.80	1.83	1.94	1.84
L/H	2.28	2.28	2.17	2.15	2.26	2.34	2.30	2.17	2.12	2.15	2.22	2.34	2.22	2.31

Figure 2. Dimensions of the *P. javanensis* n. sp.and *P. javanensis elongata* n. ssp. analyzed (measurements are in mm and indexed by Plate and figure letter).

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Figure 3. Aspect ratios: Length/Width (L/W) and Length/Height (L/H) as a function of length (mm) of *P. javanensis* n. sp (blue dots) and *P. javanensis elongata* n. ssp. (orange dots).

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Plate 1. Holotype of *Pseudosimnia javanensis* n. sp., 11.5 mm in length (IGF105105).

Plate 2. *Pseudosimnia javanensis* n. sp. in matrix, 18.3 mm in length: **A**= on compressed sand; **B**= on rock.

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Plate 3. ***Pseudosimnia javanensis*** **n. sp. paratypes and corresponding lengths: A**= 14.9 mm; **B**= 15.8 mm; **C**= 16.2 mm; **D**= 14.0 mm; **E**= 11.3 mm; **F**= 12.0 mm; **G**= 13.4 mm; **H**= 17.9 mm; **I**= 13.9 mm; **J**= 12.2 mm; **K**= 9.3 mm.

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Plate 4. ***Pseudosimnia javanensis elongata*** **n. ssp.:** Holotype: **B**= 18.3 mm (IGF105162); paratypes: **A**= 15.6 mm; **C**= 13.8 mm; **D**= 11.5 mm; **E**= 11.2 mm; **F**= 13.8 mm; **G**= 12.1 mm; **H**= 13.6 mm; **I**= 17.0 mm; **J**= 14.3 mm; **K**= 15.0 mm; **L**= 15.6 mm; **M**= 17.5 mm; **N**= 12.7 mm.

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Volume: 55 THE FESTIVUS ISSUE 3

A New *Fasciolaria* (Fasciolariidae: Fasciolariinae) from the Yucatan Peninsula of Mexico

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ABSTRACT A new species of True Tulip Shell in the genus *Fasciolaria* has been discovered in coral reef areas along the eastern coast of the Yucatan Peninsula of Mexico. This new Mexican fasciolariid, here named *Fasciolaria haleyi* new species Berschauer & Petuch 2023, has the most inflated and rotund shell of any member of its genus and can be distinguished by its polished and highly-colorful shell. This new Yucatan endemic is morphologically closest only to the newly-described *Fasciolaria bittneri* Petuch and Berschauer, 2023 from the Dry Tortugas of Florida and represents the fourth-known *Fasciolaria* species to occur in the Gulf of Mexico.

KEY WORDS *Fasciolaria*, *Fasciolaria haleyi*, Fasciolariidae, Yucatan Peninsula, Mexico

INTRODUCTION

While gathering data and specimens for our research on the mollusks of the Yucatan Peninsula, we became aware of a large, highly-inflated and globose Tulip Shell in the genus *Fasciolaria* which has remained overlooked and undescribed until present time. This unusual fasciolariid is most similar to the recently-described *Fasciolaria bittneri* Petuch & Berschauer, 2023 (Plate 2 C, D) from the Dry Tortugas, western Florida Keys but can be separated from that species by possessing several significant differences in shell characters. These are discussed in the following sections of this paper. The new Yucatan species is part of a previously-unrecognized Gulf of Mexico species complex, which also includes the wide-ranging western Atlantic *Fasciolaria tulipa* (Linnaeus, 1758) (Plate 2 E, F) and the deep-water Gulf endemic *Fasciolaria bullisi* Lyons, 1972, demonstrating that there are actually four different *Fasciolaria s.s.* species residing in the Gulf of Mexico (Petuch & Berschauer, 2023 for a review of all known living and fossil *Fasciolaria* species).

This distinctive new species has been collected in large numbers by Mexican shrimpers who trawl the shrimping grounds along the eastern coast of the Yucatan Peninsula, particularly in the area between Isla Contoy and Cabo Catoche to Playa del Carmen. The new Tulip Shell, and many other rarely-seen Yucatan endemic species, are collected as by-catch in the shrimp nets and are sold to local craftsmen who use them to make curios for the tourist trade. Indeed, several specimens in the type lot of this new species had been filled with wax and wicks and made into candles for sale in local gift shops. These large and colorful candle holders caught the attention of a Playa del Carmen businessman and inspired amateur malacologist, Kevin Haley, who conveyed the information to us and later generously donated research specimens.

ISSN 0738-9388

SYSTEMATICS

Phylum	Mollusca Linnaeus, 1758
Class	Gastropoda Civier, 1795
Order	Neogastropoda Wenz, 1938
Superfamily	Buccinoidea Rafinesque, 1815
Family	Fasciolariidae Gray, 1853
Subfamily	Fasciolariinae Gray, 1853
Genus	*Fasciolaria* Lamarck, 1799

Fasciolaria haleyi Berschauer & Petuch, new species
(Plate 1, Figures A-G; Plate 2 Figures A, B)

Description. Shell large for genus, averaging 145 mm in length as adults, thick and heavy, broadly fusiform and ovate, with high elevated spire; body whorl greatly inflated, rotund, with distinctly angled shoulder; spire whorls with more prominently-angled shoulders, becoming more obviously acute on earlier whorls; protoconch rounded and dome-like, orange-brown or reddish-brown in color, with postnuclear and early whorls being ornamented with 10-12 low, elongated ribs; ribs of early whorls crossed by 5 thin spiral cords, producing faint cancellate appearance; siphonal canal proportionally short and stubby, only two-thirds length of spire; body whorl smooth and polished, without raised cords; siphonal canal ornamented with 12-15 large, prominent, rounded cords; sutures of spire whorls indented and minutely canaliculate; subsutural area of body whorl and spire whorls distinctly sloping, producing wide adherent band or subsutural collar; entire subsutural band sculpted with 3 shallowly-incised spiral grooves; shell base color white or white with pale blue infusions, overlaid with 3 wide bands of amorphous and widely-scattered patches of dark brown, reddish-brown, or bright orange-red; color patches, in turn, overlaid with 20-25 thin, evenly-separated dark chocolate-brown spiral bands; smaller, thinner subsidiary bands sometimes present between pair of primary bands; dark bands variable in thickness, being thicker in some areas and thinner in others and often breaking apart to form elongated dashes; dark bands terminating in small denticals at edge of lip forming serrated appearance; siphonal canal dark red or brown, overlaid with white cords; aperture wide and flaring, broadly oval, corresponding to inflated body whorl; columella pale orange in color, with 2 large, prominent recurved plicae; interior of aperture color varying from white to pale orange; inner edge of lip ornamented with numerous very fine, thread-like ridges.

Type Material. Holotype - length 145.6 mm, width 73.9 mm, off Cabo Catoche, Quintana Roo, Mexico, SBMNH 183616; Paratypes – four specimens from the same locality and depth as the holotype: lengths 139.7 mm and 148.9 mm in the research collection of the senior author; lengths 144.0 mm and 147.9 mm in the research collection of the junior author.

Type Locality. Trawled from 20 m depth, in sand and coral rubble, off Cabo Catoche, Quintana Roo State, Yucatan Peninsula, Mexico.

Distribution. Restricted to the eastern coast of the Yucatan Peninsula and is most often collected in an area extending from Cabo Catoche to Isla del Carmen. *Fasciolaria haleyi* inhabits carbonate sand sea floors near living coral reefs, in depths varying from 1 to 25 m.

Etymology. Named for Kevin Haley of Playa del Carmen, Quintana Roo, Mexico who discovered the new species and who kindly donated the type lot.

Discussion. Of the four known species of *Fasciolaria* (*sensu stricto*) living in the Gulf of Mexico, *F. haleyi* most closely resembles the Floridian *F. bittneri* Petuch & Berschauer, 2023 (Plate 2 C, D) but differs in having a much larger and more inflated shell, with the Yucatan species being roughly one-third wider across the mid-body than its Floridian congener. The siphonal canal of *F. haleyi* is also proportionally

ISSN 0738-9388

much shorter and truncated, being only one-half the length of *F. bittneri*, a character difference that shows up well when comparing the specimens illustrated here on Plate 2. The sloping band of the subsutural collar on *F. haleyi* is also proportionally much wider and more prominent than that of *F. bittneri*, as well as being much more indented at the shoulder-collar juncture. Both shells are smooth and polished, lacking any strong cords on the body whorl, a shell character that is prominent on the closely-related *F. tulipa* (Linnaeus, 1758) (Plate 2 E, F). The dark color bands on *F. haleyi* are also proportionally thicker and less discretely-defined than those on *F. bittneri* and *F. tulipa*, and have a smeared appearance. *F. haleyi* has three known color forms: solid red, red with ivory markings, and dark brown with ivory markings.

As seen here on Plate 2 (Figures B, D, & F), the early whorls of the three shallow water Gulf of Mexico species differ substantially and can be used to differentiate the individual taxa. Both *F. bittneri* and *F. haleyi* have distinctive angled early whorls, while those of *F. tulipa* are rounded. The most striking shell character seen on the Yucatan and Florida endemic species is seen in the very sharply-angled postnuclear whorls, which are heavily ornamented with prominent knobs and ribs. On *F. bittneri*, the knobs of the early whorls are the best-developed of the two species (Plate 2 D), resembling those seen on peristerniine fasciolariids such as *Leucozonia* or *Polygona*. The postnuclear knobs of *F. haleyi* are not as well-developed as those of its Floridian congener and are lower and more rounded and are overlaid with numerous small spiral cords, producing a cancellate appearance. The prominent sutural collar of spiral cords that is so prominent on *F. tulipa* is completely absent on both *F. bittneri* and *F. haleyi*. This absence of strong subsutural cords is also seen in the deep-water *F. bullisi*. In an interesting taxonomic note, *F. haleyi* has recently become available on worldwide shell dealer's lists, but has been misidentified as "*Fasciolaria hollisteri* Weisbord, 1962". That taxon, however, is referable only to a Pliocene fossil species from the Mare Formation of Venezuela and is known from a single specimen (Crabos & Queiroz, 2023 for illustrations of the holotype of the fossil *hollisteri* and for a comparison of the fossil with other living western Atlantic *Fasciolaria* species).

ACKNOWLEDGMENTS

We thank Kevin Haley, Playa del Carmen, Mexico for bringing this important new endemic species to our attention and for generously donating specimens for our research on Yucatan mollusks.

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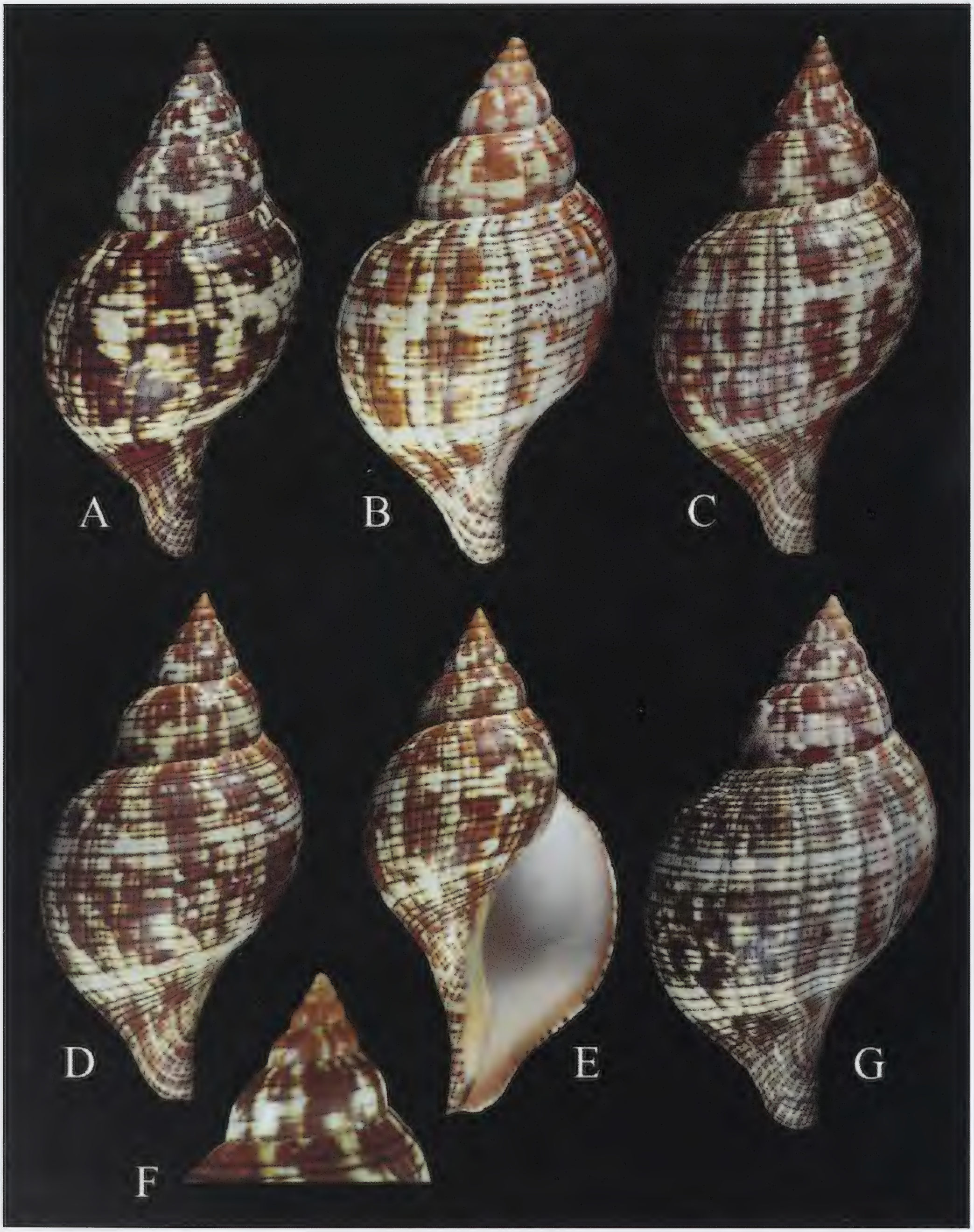

Plate 1. *Fasciolaria haleyi* Berschauer & Petuch, n. sp. from off Cabo Catoche, Quintana Roo, Yucatan Peninsula, Mexico.
C= *Fasciolaria haleyi* new species, SBMNH 183616, holotype, length 145.6 mm; Paratypes: **A**= length 144.0 mm, in the Petuch research collection; **B**= length 147.9 mm, in the Petuch research collection; Paratypes: **D, E, F**= length 139.7 mm, in the Berschauer research collection; **G**= length 148.9 mm, in the Berschauer research collection.

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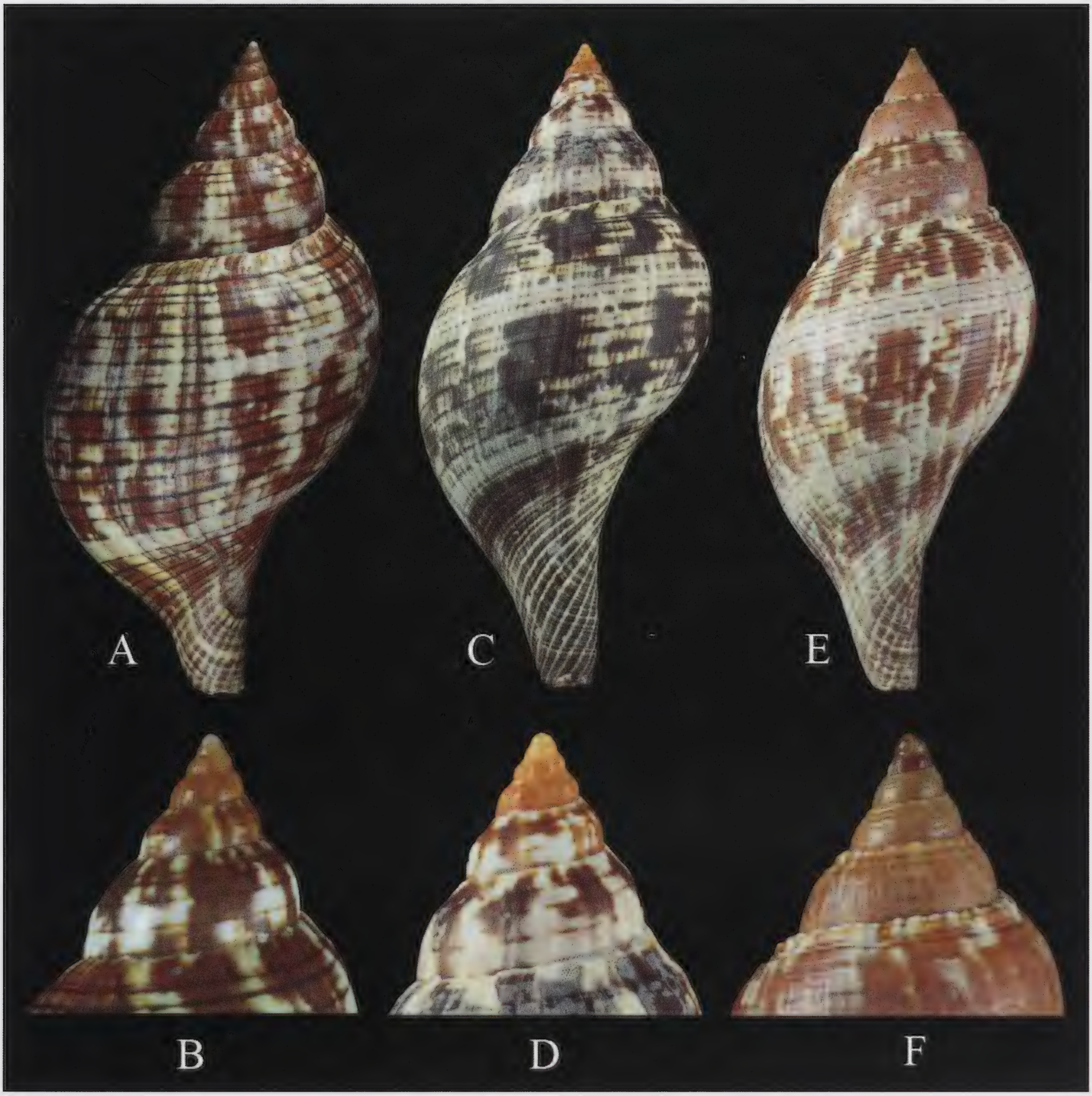

Plate 2. Comparison of *Fasciolaria* species from the Gulf of Mexico.
A= *Fasciolaria haleyi* new species, holotype, length 145.6 mm, from off Cabo Catoche, Mexico; **B**= detail of the spire whorls of *Fasciolaria haleyi*; **C**= *Fasciolaria bittneri* Petuch & Berschauer, 2023, holotype, length 115.1 mm, from off the Dry Tortugas, Florida; **D**= detail of the spire whorls of *Fasciolaria bittneri*; **E**= *Fasciolaria tulipa* (Linnaeus, 1758), length 124.4 mm, from Sanibel Island, Florida; **F**= detail of the spire whorls of a different specimen of *Fasciolaria tulipa* with a fully intact protoconch.

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A New Endemic Species of *Miliariconus* Tucker & Tenorio, 2009 (Gastropoda: Conidae) from Western Australia

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ABSTRACT A new species of *Miliariconus* from tropical Western Australia, is described based on morphological differences with known taxa from that region. The new species differs from known Australian species in sculptural form and colour. This species further highlights the endemism of much of the new taxa that is being discovered in remote northern Australia.

KEY WORDS Gastropoda, Conidae, *Miliariconus*, *M. cantamessae*, Western Australia, new species, endemism

INTRODUCTION

The cone complex *Miliariconus* is characterised by a high degree of localised endemism with half of all known taxa restricted to small geographical areas or islands (Tucker & Tenorio, 2013). It has been hypothesised that this high degree of endemism is a consequence of the loss of the planktotrophic larvae stage and the utilisation of direct development (Petuch & Berschauer 2016). This endemism and the developmental life of *Miliariconus* taxa has implications for assessing the biodiversity particularly from isolated islands (Petuch & Berschauer 2016).

The Dampierian Molluscan Province, within the North Australian Tropical Region a described in Petuch & Berchauer, 2020, is home to many endemic species including: *Chicoreus cervicornis* (Lamarck, 1822), *Amoria praetexta* (Reeve, 1849), *Proxoliva brettinghami* (Bridgman, 1909) and *Plicaustraconus trigonus* (Reeve, 1848). Notwithstanding, the region has hitherto remained relatively under-reported in terms of published taxonomic molluscan surveys. One of the primary reasons for the discovery of new taxa in this region is the improved accessibility to formally isolated regions of the coastline via guided boat tours to reefs and islands typically not visited. New age explorers have returned from expeditions with a wealth of information on range extensions of well-known species, as well as uncovered many new taxa including gastropods. This paper describes a new morphological species of *Miliariconus* that was found on one such expedition.

METHODS

Specimens of a purported new species were observed in the Valda Cantamessa Collection (n = 9). These were identified as self-collected material taken in September of 2013. The form and sculpture, as well as the level of variability in colour and pattern were used as comparative characteristics. The new species was described with consideration of the localised and remote

ISSN 0738-9388

known distribution: endemicity is not uncommon in the direct developing Conidae.

SYSTEMATICS

Class	Gastropoda Cuvier, 1795
Subclass	Sobreoconcha Ponder & Lindberg, 1997
Order	Prosobranchia Milne-Edwards, 1848
Infraorder	Neogastropoda Wenz, 1938
Superfamily	Conoidea Fleming, 1822
Family	Conidae Fleming, 1822
Subfamily	Puncticulinae Tucker & Tenorio, 2009
Genus	*Miliariconus* Tucker & Tenorio, 2009

Miliariconus cantamessae Maxwell and Berschauer, new species
(Figure 1; Plate 1 Figures A-D, Plate 2 Figure B)

Description. Shell of average size for genus (holotype length 24.5 mm, width 15.6 mm), vasiform, turbinate, inflated, stocky, with distinctly rounded sides; spire proportionally low, broadly subpyramidal; sutural ramps with three spiral grooves which are even and proportionally similar; spiral grooves on sutural ramps form boundary for three cords, which reduce in size by approximately half with each subsequent cord from suture; lacking sutural ramp spiral lines on later whorls; adapical half of body whorl with even distinctive smooth bands approximately one millimetre wide; inter-spaces of bands smooth, quadrate, uniform and without crenulations; shell body uniformly light blue with lighter band on lower third of body whole, otherwise without pattern; top of shell from shoulder uniformly creamy-white; inner aperture with dark brown-purple interior divided in half by axial cream band; top of aperture and outer lip is reflective of outer spire colouration.

Type Material. Holotype – Deposited in the Blue Sky Research Foundation Collection, No. TC009, Cassini Island, Australia (length 24.5 mm, width 15.6 mm) (Figure 1). All paratypes were found intertidally off Cassini Island, and are maintained in the Valda Cantamessa Collection. Paratype 1: length 32.2 mm, width 20.3 mm; Paratype 2: length 29.0 mm, width 17.0 mm; Paratype 3: length 25.3 mm, width 17.4 mm; Paratype 4: length 26.8 mm, width 16.7 mm; and Paratype 5: length 25.3 mm, width 15.9 mm.

Type Locality. Cassini Island, Kimberly Coast, Northern Western Australia, due north of the Kimberley Coral Reefs (13°56′43′′S: 125°37′52′′E) (Figure 2).

Habitat. Found intertidally in sand on reef in association with coral.

Distribution. At present this species is known only from Cassini Island, due north of the Kimberly Coastal Reefs of the Damperian Province in NW Australia.

Variability. There is very little variability found in the type population. All specimens examined show a distinctive lack of patination of the shell as well as uniformity in structural presentation.

Etymology. This species is named in honour of Valda Cantamessa from Proserpine, Queensland. Mrs. Cantamessa found the types while on a private expedition to North Western Australia. Furthermore, Mrs. Cantamessa has been a collector of shells for over 30 years and has a long history of active participation in numerous shell clubs in Queensland, and a Life Member of the Townsville Shell Club. Mrs. Cantamessa has supported malacological research through her generous donations of specimens from her private collection.

Comparison and Remarks. One of the most significant distinguishing features of the new species is the colouration; however, it does differ structurally from other members of *Miliariconus*. In Australia, there are three

ISSN 0738-9388

currently recognised members of the *Miliariconus* (Plate 1): *Miliariconus aristophanes* (Sowerby I, 1857); *M. coronatus* (Gmelin, 1791) (not *Conus coronatus* Reeve, 1849) and *M. miliaris* (Hwass in Bruguière, 1792) (Röckel *et al*., 1995; Tucker & Tenorio, 2013; Petuch & Berschauer, 2016). While the number of sutural ramp grooves varies in *M. coronatus* from 1-7 and in *M. miliaris* from 4-5 the new species is restricted to three (Röckel *et al*., 1995). The new species differs from *M. aristophanes* in having finer spiral ribbing on the lower half, and with rounder shoulder coronations. Furthermore, the new species lacks the shell colouration and patterns typical of *M. aristophanes*, *M. coronatus* and *M. miliaris*.

The *Miliariconus* can be divided into two groups based on the distribution pattern of the species. The first group is broadly distributed (Petuch & Berschauer 2016) and includes: *Miliariconus aristophanes* = Philippines, Melanesia, Polynesia, and Queensland; *Miliariconus coronatus* = Indo-Pacific; *Miliariconus miliaris* = Africa to Polynesia; *Miliariconus taeniatus* (Hwass, 1792) = Red Sea and coast of Oman; *Miliariconus tiaratus* (Sowerby I, 1833) = Gulf of California to the Galapagos (Plate 2). The second group consists of endemics, which have limited ranges often restricted to islands or small connected geographical areas and contains (Petuch & Berschauer 2016): *Miliariconus abbreviatus* (Reeve, 1843) = Hawaiian Islands; *Miliariconus canatmessae* = North Western Australia; *Miliariconus encaustus* (Kiener, 1845) = Marquesas Islands; *Miliariconus fulgetrum* (Sowerby I, 1834) = Japan and the Ryukyu Islands; *Miliariconus pascuensis* (Rehder, 1980) - Easter Island; *Miliariconus roosevelti* (Bartsch & Rehder, 1939) = Clipperton Island; *Miliariconus sinaiensis* Petuch & Berschauer, 2016 = Northern Red Sea (Plate 2). This indicates that the genus has a high propensity toward endemism, and therefore we may expect more species to be added the complex through time. As we previously noted, the taxonomic status of some of these endemics are in contention, and their validity is outside the scope of this paper.

CONCLUSION

We present a new endemic species of *Miliariconus* from North Western Australia. *Miliariconus cantamessae* differs in sculptural from and is remarkable for its lack of variability in colouration; rarely deviating in design or colour. The new species is typical of most members of the genus in being endemic. However, now that the species has been described that this range may well expand as additional field collecting is expected. The form of the shoulder of the body whorl and other morphological characteristics enable the species to be separated from many of its sister taxa that are known to come in rare colour forms, some of which may mimic the new species (for comparison photos see Plate 2, Figure C).

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The authors thank Valda Cantamessa for providing the type specimen and allowing the use of her extensive well curated reference collection for comparative analysis. The authors are grateful for the assistance of Trevor and Marguerite Young who provided locality and habitat information, specimens and comments on the paper.

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Figure 1. The holotype of *Miliariconus cantamessae* n. sp. (TC 009) Cassini Island, Western Australia, length 24.5 mm, width 15.6 mm and enlarged image of the operculum and: **A**= The shoulder; **B**= the spiral sculpture; **C**= the body whole sculpture; and **D**= the anterior of the shell.

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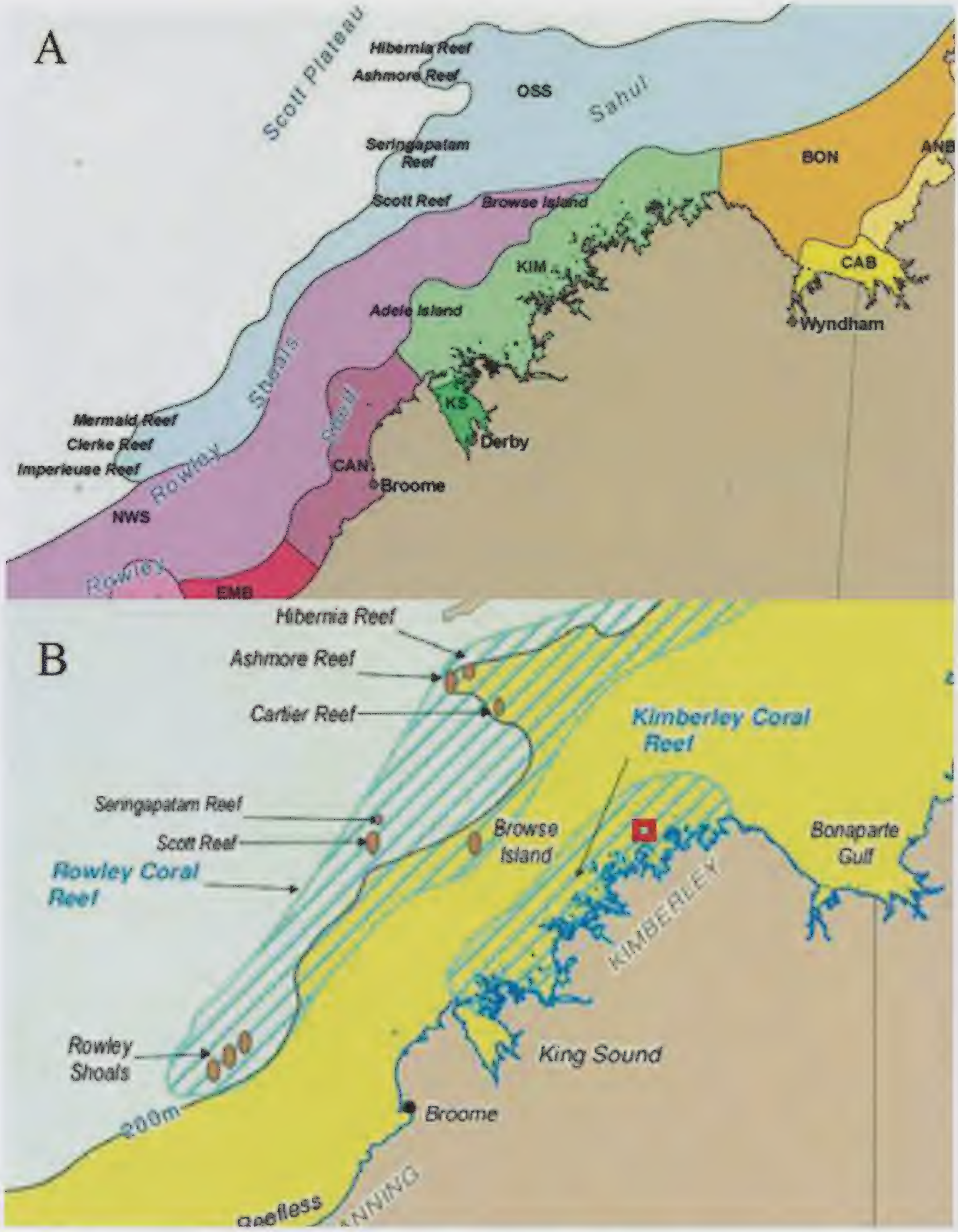

Figure 2. Within the Damperian Molluscan Province (Petuch & Berschauer 2020), *Miliariconus canatamessae* is known from Cassini Island (shown by the red square), which is located north of and offshore from the Kimberly Coral Reefs (of the Australian government's Integrated Marine and Coastal Regionalisation of Australia mesoscale bioregion, which is associated with the Kimberley Coral Reefs area). **A**= The coastal mesoscale bioregions (map adapted from Wilson 2013, fig. 1.5): ANB - Anson-Beagle; BON - Bonaparte Gulf; CAB - Cambridge-Bonaparte; OSS - Oceanic Shoals; KIM - Kimberley; KS - King Sound; CAN - Canning; NWS - North West Shelf; EMB - Eighty Mile Beach. **B**= The reef systems and their distribution in north West Australia of the new species (map adapted from Wilson 2013, fig. 4.1).

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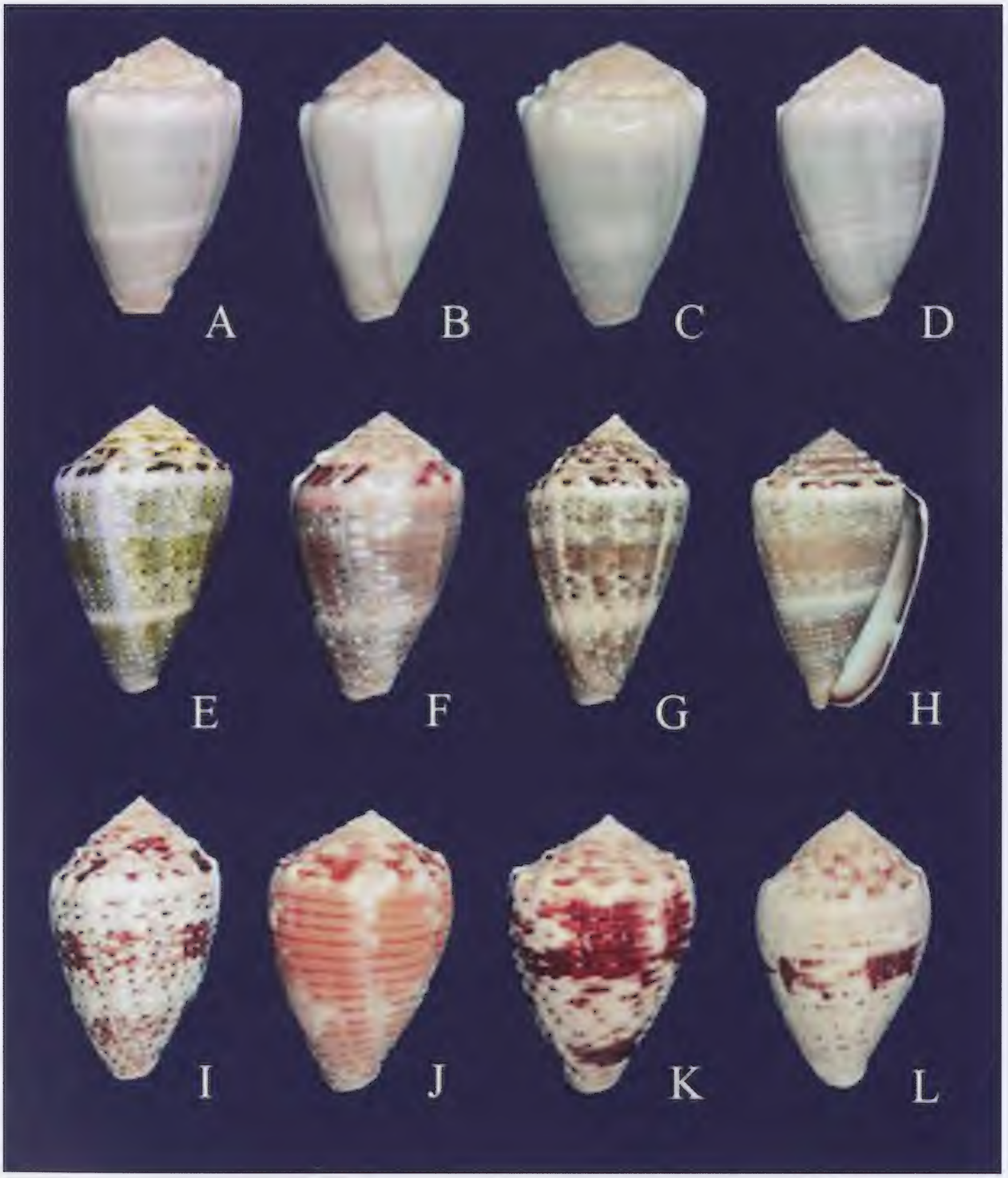

Plate 1. Comparative images to the new species. ***Miliariconus cantamessae*: A**= Paratype 1 – Cassini Island, WA, length 32.2 mm, width 20.3 mm; **B**= Paratype 2 – Cassini Island, WA, length 29.0 mm, width 17.0 mm; **C**= Paratype 3 – Cassini Island, WA, length 25.3 mm, width 17.4 mm; **D**= Paratype 4 – Cassini Island, WA, length 26.8 mm, width 16.7 mm. ***Miliariconus coronatus*: E**= Yule Point, Qld, 36.3 mm; **F**= Cassini Island, WA, 38.2 mm; **G**= Oak Beach, Qld, 44.2 mm; **H**= Heron Island, Qld, 37.4 mm. ***Miliariconus aristophanes:*** **I**= Wilson Island, Qld., 43.7 mm; **J**= Wilson Island, Qld., 30.3 mm; and **K**= Heron Island, Qld, 35.6 mm; **L**= Oak Beach, Qld, 47.8 mm. (All specimens from the Valda Cantamessa collection).

ISSN 0738-9388

Plate 2. A comparative plate of *Miliariconus* species. A= *Miliariconus miliaris*, Feather Reef, Qld, 22.4 mm; **B= *Miliariconus cantamessae***, Paratype 5 - Cassini Island, WA, length 25.3 mm, width 15.9 mm; **C= *Miliariconus coronatus***, Saddleback Island, Qld, 35.5 mm; **D= *Miliariconus aristophanes***, Green Island, Qld, 28.4 mm; **E= *Miliariconus encaustus***, Marquesas, 32.5 mm; **F= *Miliariconus taeniatus***, Arabian Gulf, 29.6; **G= *Miliariconus fulgetrum***, Horseshoe Reef, Japan, 22.6 mm; **H= *Miliariconus tiaratus***, Santa Cruz Island, Galapagos, 35.7 mm; **I= *Miliariconus abbreviatus***, Kahulau, Hawaii, 34.78 mm; **J= *Miliariconus sinaiensis*** Sharm el-Sheikh, Egypt, paratype 1, 28.2 mm (image taken from Petuch & Berschauer. 2016, fig. 1g); **K= *Miliariconus roosevelti*** northwestern side of Clipperton Island, 20.0 mm (E.J. Petuch research collection); **L= *Miliariconus pascuensis***, Ana Kakenga, Easter Island, 27.0 mm (E.J. Petuch research collection). All specimens are from the Valda Cantamessa collection unless otherwise stated.

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A Review of *Neodilatilabrum* Dekkers, 2008 (Mollusca: Neostromboidae: Strombidae) Resulting in a New Species from Japan

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ABSTRACT The genus *Neodilatilabrum* contains taxa that are both morphologically stable across their ranges, while others are highly plastic, making the choice of discerning characteristics critical to achieving taxonomic stability. A new species of *Neodilatilabrum* from Japan is presented here. *Neodilatilabrum tasminae* n. sp. lacks the axial shoulder rib on the body whorl found in *N. robustum* and *N. sowerbyorum*. The angulate shoulders of *N. succinctum* differentiate that taxon from *N. tasminae*. *Neodilatilabrum simanoki* is placed within the synonymy of *N. sowerbyorum*, and *N. boucheti* is placed under the synonymy of *N. robustum.* This revision provides the basis from which more detailed studies into the complex variability of species, both locally and across their ranges, to be undertaken.

KEYWORDS Distribution, Gastropoda, morphology, taxonomy, *Strombus*, *Neodilatilabrum, Neodilatilabrum tasminae, N. succinctum, N. simanoki, N. sowerbyorum, N. boucheti, N. robustum*

INTRODUCTION

The taxonomic tree of the stromboideans has bloomed over the last decade with a wave of renewal that has revived taxonomic and collecting interest in the complex. Molecular conformation of historical taxonomy has given renewed confidence in the viability of classical taxonomic practice to explain effectively and robustly the diversity of the stromboideans (Latiolais *et al.* 2006; Machkour-M'Rabet *et al.* 2021; Irwin *et al.* 2021). More recently, classical taxonomic studies into stromboidean generic relationships (Dekkers & Maxwell 2020; Maxwell *et al.* 2020). This has been concurrent with revisions of many stromboidean genera such as *Canarium* (Liverani *et al.* 2021); *Doxander* (Maxwell 2022b); *Gibberulus* (Maxwell *et al.* 2021); *Ministrombus* (Maxwell 2022a), studies which have resulted the description of new taxa. The focus of this study, *Neodilatilabrum*, is a similar review of a genus in the family Strombidae.

The taxonomy of *Neodilatilabrum* has been well studied this century with an attainment of a greater understanding of higher taxonomic relationships (Dekkers & Maxwell 2020; Maxwell 2021), better understanding of type material (Kronenberg 2008; Kronenberg *et al.* 2019; Vertriest 2022), the recognition of new taxa (Visser & Man in 't Veld 2005; Liverani 2013; Thach 2016; Vertriest 2022), and increased knowledge of the distribution of species within the complex (Maxwell 2022c). However, confusion remains over the taxonomic composition of the central Indo-Pacific with the number of recognised taxonomic hypotheses varying between authors (Kronenberg *et al.* 2008; Vertriest 2022). This study seeks to provide an evidence-based set of hypotheses to explain the observable variability within extant *Neodilatilabrum*.

ISSN 0738-9388

METHODS

The type of each *Neodilatilabrum* was examined (Figure 1), and the synonymy for each of these re-examined for morphological differences (Box 1) and biogeographical significance (Petuch & Berschauer 2020). Type locations, where possible, should reflect the location of the holotype. Range data presented in the literature for each taxon was used to assess appropriateness of its type location, and were appropriate amended. Selected literature is provided for each taxon presented to illustrate synonymies and changes in generic affiliations.
This paper utilises two codes of nomenclature. The PhyloCode (2019) for clades that are at the primary rank (genus) and above. Subgenera are not defined under the PhyloCode herein, and like species, are constructed to be compliant with the ICZN (1999). New species are described based on morphological differences and biogeography.

Distribution records for material examined that have been published in prior works have been treated as a location citation, and not classified as material seen. This avoids confusion and duplication of existing distributional records. New locality records are listed where appropriate under the respective taxon and/or listed in the caption of a figure. Hypothesized normal ranges for each species were mapped based on specimen data and biogeography (Petuch & Berschauer 2020; Figure 1). Images of specimens are shown to the same scale throughout to provide an indication of relative sizes of the taxa.

***Neodilatilabrum* Taxonomic Key**

1.	Body whorl with sharp ridged shoulder	*N. marginatum*
	Shoulder not sharply ridged	go to 2
2.	Shell fusiform and elongated	*N. eliosae*
	Shell bi-pyramidal or bulbiform	go to 3
3.	Left dorsal body whorl without axial rib	go to 4
	Left dorsal body whorl with axial rib	go to 5
4.	Spire shoulders strongly angulate	*N. succinctum*
	Spire shoulders rounded	*N. tasminae*
5.	Body whorl bulbiformis, sutural ramp - straight to convex	*N. sowerbyorum*
	Body whorl triangulate, stutural ramp - convex to straight	*N. robustum*

Box 1. *Neodilatilabrum* taxonomic key.

ISSN 0738-9388

SYSTEMATICS

Superfamily	Stromboidea Rafinesque, 1815
Epifamily	Neostromboidae Maxwell, Dekkers, Rymer, & Congdon, 2019 [Maxwell 2021]
Family	Strombidae Rafinesque,1815 [Maxwell 2021]
Subfamily	Neostrombinae Maxwell & Rymer, 2021 [Maxwell 2021]
Tribe	*Dolomenini* Dekkers & Maxwell, 2020 [Maxwell 2021]

Neodilatilabrum
Dekkers, 2008 [Maxwell 2021]

Description. "Stromboidal notch sinuous. The flange is not stepped. Spire with distinct shoulder with knobs. Body whorl shiny and almost without any sculpture; expanded outer lip thickened at the inner edge and smooth. Aperture smooth within. Columellar smooth, with callous, well-marked. The anterior canal is short. The stromboid notch is moderately developed. The posterior canal is present" (Dekkers & Maxwell 2020).
Type Species. *Neodilatilabrum marginatum* (Linné, 1758).
Definition. The maximum clade consisting of *Neodilatilabrum marginatum* (Linné, 1758) and all species that share a more recent common ancestor with them than with *Doxander vittatus* (Linné, 1758), *Dolomena pulchella* (Reeve,1851), *Labiostrombus epidromis* (Linné, 1758), *Ministrombus minimus* (Linné, 1771), *Mirabilistrombus listeri* (Gray, 1852), *Neostrombus fusiformis* (Sowerby II, 1842) or *Laevistrombus vanikorensis* (Quoy & Gaimard, 1834).
RegNum Registration Number. 583.
Reference Phylogeny. Figure 2 in Dekkers & Maxwell (2020).
Comparative Diagnosis. The *Neodilatilabrum* lacks the subsutural cord found in *Doxander* Wenz,1940 and the flange fold found in all *Dolomenina* Dekkers and Maxwell, 2020.
Synonymy.
2007 *Margistrombus* Bandel, p.153 (not available article 13.1.1).
2008 *Neodilatilabrum* Dekkers, p 58 - RegNum registration see Maxwell 2021.
2021 *Neodilatilabrum* Dekkers, 2008 - Maxwell 2021, converted clade name.

Neodilatilabrum marginatum
(Linné, 1758)
(Figure 1A, Figure 2)

Original Description. "*S. testæ labro prominula, dorso marginato lævi, cuda intega*" (Linné 1758, p. 744, no. 431).
Type Material. Museum of Evolution, Uppsala University Sweden, 1229a (Visser & Man in 'T Veld 2005; Neotype).
Type Locality. Sri Lanka (Abbott 1960).
Synonymy.
1758 *Strombus marginatus* Linné, p. 744, no. 431. Linné 1767, p. 1209, no. 499. Schröter, 1783, p. 431, Gmelin 1791, p. 3513, no. 15. = *Strombus marginatus* - Röding 1798, p. 62, nos. 779-780. = *Strombus marginatus* - Dillwyn 1817, p. 665. Kiener 1843, p. 44, pl. 16, fig. 2. Hanley 1856, p. 123. Reeve 1860, p. 93. Dodge 1956, p. 262. Dance 1974, p. 84. Abbott & Dance 1982, p. 79. = *Strombus marginatus* - Dillwyn 1817, p. 672. = *Strombus* (*Gallinula*) *marginatus* - Tryon 1885, pp. 116 & 141, pl. 5, fig. 53. = *Strombus* (*Dolomena*) *marginatus marginatus* - Abbott 1960, p. 98, pl. 18, figs. 6 & 7, pl. 74, fig. 1, pl. 75. Walls 1980, pp. 115, 116, & 189. Kreipl *et al.* 1999, pp. 12 & 42, pls. 83 & 84. Visser & Man in 'T Veld 2005, p. 56, pl. 1, figs. 1 & 2, pl. 2, fig. 1, pl. 3, figs. 1 & 2. = *Strombus marginata* - Walls 1980, p. 188.
1798 *Lambis carinata* Röding, p. 62, nos. 779 &

ISSN 0738-9388

780. Abbott 1960, p. 99. = *Lambis carinatus* - Hanley 1856, p. 123. = *Strombus carinata* - Dance 1974, p. 84. Walls 1980, p. 188.

1860 *Strombus emarginatus* Hanley, p. 74.

Records. ***India*** - Cuddalore (Dekkers & Maxwell 2020); Kilakari (Dekkers & Maxwell 2020; Visser & Man in't Veld 2005); Kilarkarai (Dekkers & Maxwell 2020); Kottai Pattanam (Dekkers & Maxwell 2020); Madras (Visser & Man in'T Veld 2005); Pamban, Gulf of Manaar ('Thurston' in Abbott 1960; Visser & Man in't Veld 2005); Ramanathapuram, Devipattanam (Dekkers & Maxwell 2020; Visser & Man in't Veld 2005); Rameswaram (Visser & Man in't Veld 2005). ***Sri Lanka*** - Pearl bank, Gulf of Manaar (Abbott 1960); Eluvativu Island (Abbott 1960); Galle (Dekkers & Maxwell 2020); Trincomalee (Dekkers & Maxwell 2020). ***Myanmar*** - North of Tavoy, Maungmagon (Abbott 1960). ***Thailand*** - Phuket (Visser & Man in't Veld 2005). ***Indonesia*** - Oebjoeng Batee Kapal ('Oostingh' in Abbott 1960); Lam Baro, Atjeh Head ('Oostingh' in Abbott 1960); Tapatoean, Sumatra (Visser & Man in't Veld 2005).

Neodilatilabrum eloiseae
(Vertriest, 2022)
(Figure 1B, Figure 3)

Original Description. "Shell very slender and elongated, shell width usually less than ½ of shell height. Shell size usual for the genus, between 33 mm and 62 mm. Coloration between pale orange brown and brown with 3 – 4 white lines on the last whorl, interrupted by a zig-zag pattern. Columella white and smooth in the centre. Faint striae present on the upper and lower columella near the siphon and posterior siphon. Aperture white with clear striae not running until the edge of the lip. Stromboid notch very shallow. 7-9 whorls with multiple varices on the spire. Top heavily structured up until around the 5th whorl. Last 2-3 whorls with faint structure. Last whorl smooth or with very faint structure up until the lip, which is faintly structured on the outside. Faint rounded dorsal keel with a knob located approximately in the centre of the dorsum. Posterior canal variable in length: from short and reaching the body whorl only to long and running up the spire for 2-3 whorls" (Vertriest 2022, pp. 93-94).

Type Material. Museum National d'Histoire Naturelle, Paris, MNHN-IM-2000-37645 (Vertriest 2022; Holotype; Figure 1B).

Type Locality. Madras, Tamil Nadu, South-East India (Vertriest 2022, p. 93).

Synonymy.

Strombus succinctus - Sowerby 1842, pl. 6, figs. 20 & 21. Kiener 1843, p. 45, pl. 10, fig. 2. Duclos 1844, pl. 12, figs. 5 & 6, pl. 21, figs. 6 & 7. Hanley 1860, p. 74. Hanley 1856, p. 124, pl. 25, fig. 30. Reeve 1860, p. 94. Dodge 1956, pp. 262 & 278. Dance 1974, p. 84. = *Strombus* (*Gallinula*) *succinctus* - Tryon 1883, p. 190, pl. 49, fig. 59. Tryon 1885, pp. 116 & 145, pl. 6, fig. 56. = *Strombus* (*Labiostrombus*) *succinctus* - Cox 1948, p. 24. = *Labiostrombus succinctus* - Iredale 1929, p. 344. Abbott & Dance 1982, p. 79. = *Strombus* (*Dolomena*) *marginatus succinctus* - Abbott 1960, p. 99, pl. 18, figs. 13 & 14. Walls 1980, pp. 117, 118 & 190. Kreipl *et al*. 1999, pp. 12 & 43, pl. 86, figs. 1-3. Visser & Man in 't Veld 2005, p. 64, pl. 1, figs. 5 & 6, pl. 2, fig. 3, pl. 3, fig. 7. = *Strombus* (*Margistrombus*) *succinctus* - Bandel 2007, p. 154, fig. 20a. = *Margistrombus succinctus* - Liverani 2013, pl. 153, fig. 1. = *Neodilatilabrum succinctum* - Dekkers & Maxwell 2020, p. 57, fig. 3k. [not *Strombus succinctus* Linné, 1767 which is valid]

2022 *Margistrombus eloiseae* Vertriest, p. 90, pl. 3.

ISSN 0738-9388

Records. ***India*** - Auroville (Vertriest 2022); Colachel (Vertriest 2022); Cuddalore (Dekkers & Maxwell 2020; Vertriest 2022); Kottai Pattinam (Dekkers & Maxwell 2020; Vertriest 2022); Madras (Abbott 1960; Dekkers & Maxwell 2020; Vertriest 2022); Rameswaram (Vertriest 2022); Tamil Nadu (Vertriest 2022); Thondi (Vertriest 2022); Tuticorin (Dekkers & Maxwell 2020; Vertriest 2022). ***Sri Lanka*** - Ara point, Nilaveli (Abbott 1960); Colombo (Vertriest 2022); Galle (Dekkers & Maxwell 2020; Vertriest 2022); Jaffnah (Vertriest 2022); Kalkudah (Vertriest 2022); Kuchchaveli (Vertriest 2022); Lavinia (Dekkers & Maxwell 2020; Vertriest 2022); Pearl Banks, Gulf of Manaar (Abbott 1960); Matara (Vertriest 2022); Trincomalee (Abbott 1960; Vertriest 2022). ***Thailand*** - Andaman Sea, Ko Chan Island (Vertriest 2022).

Neodilatilabrum robustum
(Sowerby, 1875)
(Figure 1C, Figure 4, Figures 9B-H)

Original Description. "*S. testa conica, solida, ventricosa, cæruleo-alba, castaneo zonata et maculata ; spira parviuscula acuta; anfractibus nodulosoangulatis, superne spiraliter striatis; anfractu ultimo in medio fere lævi, deinde versus marginem conspicue striato, ad basinsulcato; apertura elongata, canali superne spiram ascendente; columella callosa, alba, obsolete lirata; labio externo emarginato, intus lirato…* Shell conoid, solid, ventricose, bluish white, banded and blotched with dark brown; spire rather short, acute; whorls angulated and noduled at the angle, spirally striated above; last whorl almost smooth in the middle, then towards the margin conspicuously striated, grooved at the base; aperture elongated, with a canal at the upper part, running up the spire; columella furnished with a thickened white enamel, which is faintly ridged; outer lip emarginated; interior ridged" (Sowerby 1875, p. 599).

Type Material. Natural History Museum (UK) no. 20100312 (Kronenberg *et al*. 2019; Lectotype; Figure 1C).

Type Locality. Hong Kong, China (Sowerby 1875).

Synonymy.

1875 *Strombus robustus* Sowerby, pl. 22, figs. 3 & 3a. Tryon 1885, pp. 116 & 144, pl. 5, fig. 54. Dodge 1956, pp. 264 & 280. = *Strombus* (*Dolomena*) *marginatus marginatus var. robustus* - Walls 1980, pp. 115, 116 & 190. = *Margistrombus robustus* - Kronenberg *et al*. 2019, figs. 2a & b, 4-6. = *Neodilatilabrum robustum* - Maxwell 2022, fig. 1.

2016 *Margistrombus boucheti* Thach, p. 39, figs. 77-82 (Figure 1H). Kronenberg *et al*. 2019, figs. 8a, b, & c,
Strombus marginatus - Cob *et al*. 2008, p. 618, fig. 10b [non *Strombus marginatus* Linné, 1758 which is valid].

Records. ***Thailand*** - Koh Chang (Abbott 1960); Koh Samet (Abbott 1960); Khan Nu Paknam (Abbott 1960); Ban Ao Moo, Bang Ko Chai (Abbott 1960); ***Hong Kong*** - south of Lema Island (Abbott 1960). ***Malaysia*** - Merambong Shoal, Johor Straits (Cob *et al*. 2008). Philippines - Corregidor Island (Dekkers & Maxwell 2020). ***Singapore*** - Changi Coast Walk (Dekkers & Maxwell 2020; Chim *et al*. 2009). ***Vietnam*** - Nah Trang (Thach 2016); An Dang Beach (Dekkers & Maxwell 2020); Mui Ne (Dekkers & Maxwell 2020). ***Australia*** - Dingo Beach (Maxwell 2022); Point Cartwright (Maxwell 2022a).

Neodilatilabrum sowerbyorum
(Visser & Man in't Veld, 2005)
(Figure 1E, Figure 5)

Original Description. "This is what Abbott described as the heavier and more rotund

ISSN 0738-9388

subspecies. The shell is indeed globose and always without a keel present on the shoulder of *S. m. marginatus*. Very characteristic for this subspecies in the plication ventrally on the left, forming a thin rib. The length of shell varies from 25-65 mm. The anal canal extends up the spire and often bends sharply to the left, well onto the spire whorls" (Visser & Man in't Veld 2005, p. 59).

Type Material. Natuurmuseum Rotterdam 15986 (Visser & Man in't Veld 2005; Holotype; Figure 1D).

Type Locality. Kuala Beliat, Borneo, Brunei (Visser & Man in't Veld 2005).

Synonymy.

1767 *Strombus uccinctus* Linnaeus, p. 1212, no. 509, in part. = *Strombus accinctus* Linnaeus 1767, p. 1212, no. 509, in part. = *Strombus accinctus* Born 1778, pp. 280 & 281 in part. Born 1780, p. 283, pl. 10, figs. 14 &15. [non *Strombus succinctus* Linné, 1767 which is valid],

2005 *Strombus (Dolomena) marginatus sowerbyorum* Visser & Man in 't Veld, pp. 58-60, pl. 1, figs. 3 & 4, pl. 2, fig. 2, pl. 3, figs. 3 & 4. Chim *et al*. 2009, p. 379, figs. 1-5. = *Strombus sowerbyorum* - Kronenberg 2008, p. 62, figs. 9-15.

2013 *Margistrombus simanoki* Liverani, p. 77, pl. 1, figs. 1 & 2 (Figure 1H).

Strombus (Dolomena) marginatus robustus - Abbott, 1960, p. 100, pl. 76, figs. 1 & 2. = *Dolomena marginata marginata robusta* - Raven 2002, pp. 11 & 12, pl. 3, figs. 15-17, pl. 4, figs. 18-22. = *Margistrombus robustus* - Kronenberg *et al*. 2019, figs. 7a-c, [non *Strombus robustus* Sowerby, 1875 which is valid].

Records. ***Brunei*** – Belait (Raven 2002; Visser & Man in't Veld 2006); Tutong (Raven 2002). Sarawak (Abbott 1960); Tapaktuan, Aceh Province (Liverani 2013). ***Malaysia*** - Santubong (Raven 2002); Bekenu (Raven 2002); Miri (Raven 2002); Baram River (Raven 2002); Labuan Island (Raven 2002); Tanjung Aru Beach, Kota Kinabalu (Raven 2002); Kudat Bay (Raven 2002); Cherating (Raven 2002); Kuala Terengganu (Raven 2002).

Neodilatilabrum succinctum
(Linné, 1767)
(Figure 1F, Figure 6)

Original Description. "*S. testa labro rotundato retuso, ventre laevi cingulis quatuor pallidis lineari-punctatis… Testa laevis, testacea, dorso subcarinato cincto lineis bigeminis albo-punctatis. Spirae anfractus striati carinula crenata. Labrum exterius intus striatum; Interius adnatum, laeve, gibbum, antice substriatum*" (Linné 1767, p. 1212).

Type Material. Linnean Society of London Collection no. 437 (Dodge 1956; Lectotype; Figure 1E).

Type Locality. Luzong, Bataan Peninsula, Luzon Island, Philippines (Vertriest 2022).

Synonymy.

1767 *Strombus ccinctus* Linné, p. 1212, no. 509. = *Strombus accinctus* Linné, 1767a, p. 1212, no. 509. Born 1778, p. 280. Dillwyn 1817, p. 672; Hanley 1856, p. 124. Tryon 1885, p. 135. Dodge 1956, p. 279. Abbott 1960, p. 100. = *Strombus succinctus* Gmelin, 1791, p. 3518; no. 26, in part. = *Lambis succinta* Röding 1798, p. 62, no. 781. = *Strombus succinctus* Dillwyn 1817, p. 672. = *Marigistrombus succinctus* - Vertriest 2022, p. 90, pl. 2, figs. A-E.

1844 *Strombus septimus* Duclos, pl. 13, figs. 9 & 10, pl. 15, fig. 11, pl. 26, fig. 2. = *Strombus (Gallinula) succinctus septimus* – Tryon 1885, pp. 117 & 144, pl. 6, fig. 57. = *Strombus septimus* - Dodge 1956, p. 279. = *Strombus marginatus septimus* - Hinton 1972, p. 10, pl. 5, figs. 7 & 8. Hinton 1977a, p. 12, no. 7. Hinton 1977b, p. 9, no. 7. Abbott & Dance 1982, p. 79. = *Strombus (Dolomena) marginatus*

ISSN 0738-9388

septimus - Abbott 1960, p. 101, pl. 18, figs. 10 & 11, pl. 74, fig. 2. Walls 1980, pp. 117, 118 & 190. Cernohorsky 1972, p. 78, pl. 19, fig. 2. Springsteen & Leobrera 1986, p. 72, pl. 17, fig. 13. Kreipl *et al.* 1999, pp. 12 & 43, pl. 86, figs. 4-7. Visser & Man in 't Veld 2005, pp. 58-60, pl. 1, figs. 7-8, pl. 2, fig. 2, pl. 3, figs. 8. = *Strombus* (*Labiostrombus*) *marginatus septimus* - Willan 2000, p. 19. = *Dolomena marginata septima* - Raven 2002, pl. 4, fig. 23. = *Margistrombus septimus* - Liverani 2013, pl. 153, fig. 2. = *Neodilatilabrum septimum* - Dekkers & Maxwell 2020, p. 57, fig. 3I.

Records. ***Brunei*** (Vertriest 2022). ***Indonesia*** - Ambon (Raven 2002); Hitu, Ambon Bay, Rumahtiga (Visser & Man in 't Veld 2005). ***Philippines*** - Balicasag Island (Dekkers & Maxwell 2020; Vertriest 2022); Bantanyan Island (Vertriest 2022); Basilan Island (Abbott 1960); Bataan Island (Abbott 1960); Bohol (Dekkers & Maxwell 2020; Vertriest 2022); Garidad, Panay (Dekkers & Maxwell 2020; Vertriest 2022); Cebu, Sogod (Vertriest 2022); Dupolog, Mindanao Island (Abbott 1960); east end of Corregidor Island (Abbott 1960); Leyte Island, Albuera (Vertriest 2022); Lusong Island (Abbott 1960); Manila Bay (Dekkers & Maxwell 2020; Vertriest 2022); Marinduque (Vertriest 2022); Masbate Island (Abbott 1960); Negros (Dekkers & Maxwell 2020; Vertriest 2022); Puerto Princessa, Palawan Island (Abbott 1960); Rasal Island (Vertriest 2022); San Nicolas Shoals Light, Manila Bay (Abbott 1960); Luzon Island (Abbott 1960; Visser & Man in 't Veld 2005). ***Solomon Islands*** - Honiara (Visser & Man in 't Veld 2005; Vertriest 2022); Kakaboma (Vertriest 2022); Lunga River (Vertriest 2022); Marapa Island (Dekkers & Maxwell 2020); Marau Sound (Dekkers & Maxwell 2020); Gaudalcanal (Dekkers & Maxwell 2020). ***Papua New Guinea*** - Kieta, Bougainville (Abbott 1960); New Brittan (Hinton 1972). ***Vanuatu*** - Efate Island (Cernohorsky 1972). ***New Caledonia*** - Bourail (Abbott 1960); Touho (Vertriest 2022).

Neodilatilabrum tasminae
Maxwell, new species
(Figures 1D, 7, 8 & 9A)

Description. The ovate shell is large, heavy and solid. The early spire whorls are convex with fine even axial ribs. The rounded shoulder becomes more angular mid-development, gradually losing the axial sculpture and replacing it with incised spiral lines. The shell develops an obtusely angled shoulder by the penultimate whorl. Sutures are shallow and are positioned just below the shoulder of the proceeding whorl. While typically smooth, the body whorl is covered in finely spiral incised lines that may be diminished centrally. Shoulder knobs when present are few and obsolete. The columella is well formed and white, the posterior portion forming the side of the canal before becoming diminished. The outerlip is thickened centrally the aperture is white, and rarely violet. The posterior canal is highly variable crossing at or just above the shoulder to running the length of the spire and reflexing over the apex.

Type Material. Holotype: Okinawa, Japan, 1965, ex SMC67a.008a (Blue Sky Research Foundation Collection TC008), 61 mm (Figure 1F); Paratype 1: Koninato, Japan, 2004, SMC67a.001, 49 mm; Paratype 2: Taiwan, 2000, SMC67a.002, 52 mm; Paratype 3: Okinawa, Japan, 1965, SMC67a.003a, 64 mm; Paratype 4: Okinawa, Japan, 1965, SMC67a.003b, 60 mm; Paratype 5; Okinawa, Japan, 2005, SMC 67a.004, 59 mm.

Type Locality. Okinawa, Japan as the type locality designated herein.

Etymology. Named in honour of Dr. Tasmin Rymer for her contribution to education and advancement of excellence in research. Dr.

ISSN 0738-9388

Rymer has been awarded teaching citations for excellence in evolutionary sciences, and has also worked on stromboideans authoring new taxa and advancing the understanding of the internal cladistic relationships within the complex, as well as working on the complex's population dynamics and anatomy.

Synonymy.

Labiostrombus succinctus - Kira 1959, p. 31, pl. 15, fig. 14. Vertriest 2022, pl. 2, figs. F & G. [non *Strombus succinctus* Linné, 1767 which is valid].

Dolomena marginata robusta - Kira 1962, p. 36, pl. 16, fig. 14. = *Strombus (Dolomena) marginatus robustus* - Abbott, 1960, p. 100, pl. 18, figs. 8 & 9. [non *Strombus robustus* Sowerby 1875 which is valid].

Records. Literary records that were originally placed under *N. robustum or N. succinctus* and are placed here after biogeographical considerations. These records all fall within the hypothesised range of the new species; however, given the ability for migration of this species it is not unexpected to see individual arsing outside known ranges. ***Japan*** – Sagami Bay, Honshu Island (Abbott 1960); Kii, Honshu Island (Abbott 1960); Kominato Chib (Dekkers & Maxwell 2020); Tosa Bay, Shikoku Island (Abbott 1960); Moeshima, Kagoshima Bay, Kyushu Island (Abbott 1960); Miyazaki Prefecture ('Kuroda' in Abbott 1960). Buckner Bay, Okinawa Island (Abbott 1960); Okinawa (Dekkers & Maxwell 2020; Vertriest 2022); ***Taiwan*** – Anping (Vertriest 2022); Lavinia (Vertriest 2022). ***Philippines*** - Negros Island, 54.47 mm (Vertriest 2022); Masbate, 43.97 mm (Vertriest 2022).

Biogeographical And Comparative Remarks

The *Neodilatilabrum* can be biogeographically divided into three groups: the first cross into both the Lemurian Molluscan Province (Petuch & Berschauer 2020); a second is encapsulated within the Indo-Malaysian Province (Petuch & Berschauer 2020); and a third, with one species, *N. tasminae*, found in the Japonic Molluscan Province (Petuch & Berschauer 2020).

Within the Lemurian Molluscan Province, the Andamanian and Bengalian Subprovinces contain two species. The first, *Neodilatilabrum marginatum* is morphologically stable across its range only showing a limited variability in colour. The strongly acute shoulder of the body whorls of *N. marginatum* enables the differentiation from *N. tasminae*, which has rounded shoulders. The second, *N. eloiseae,* is found within the distribution of *N. marginatum*; however, it is more localised and restricted in range *Neodilatilabrum eloiseae* is also stable in morphology across its range and differs from *N. tasminae* in being more elongated and having a finer surface sculpture. Reports of *Neodilatilabrum marginatum* and *Neodilatilabrum eloiseae* from Singapore should be treated as sporadic or invasive occurrences and not reflective of long-term stability in presence (Visser & Man in't Veld 2005; Vertriest 2022). The Indo-Malaysian Province contains three species.

The first, *N. robustum*, which ranges within the Vietnamese Infraprovince and has occasional occurrences within the Philippinian Subprovince. *Neodilatilabrum robustum* is highly variable in its shell plasticity within and between populations. The profound differences at the ends of the morphological spectrum within this species can lead to taxonomic misadventure (= *N. boucheti*), and in error seeking to recircumscribe a species and instead describing a novel one (= *N. sowerbyorum*). *Neodilatilabrum robustum* can be differentiated from the *N. tasminae* by the presence of an axial shoulder ridge, which may be broad and thick, or rarely diminutive, a characteristic missing in the new species. Although geographically

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isolated, a population of *N. robustum* is also known to exist along the coasts of Queensland, with at least one verifiable live example from Dingo Beach having been found (Maxwell 2022). *Neodilatilabrum simanoki* is herein considered a provisional synonym of *N. sowerbyorum,* based on the variability of that species; however, reservations remain on this taxonomic arrangement given the stepped and uniform nodulation of the spire and shape of outerlip. It is this complexity in form between differing populations that complicates achieving complete taxonomic certainty using morphology.

The second, *N. sowerbyorum* is found in the Nusa Tenggaran Infraprovince on north to north eastern coasts of Borneo and is highly variable, and this can lead to taxonomic confusion. Notwithstanding, *N. sowerbyorum* differs from other members of the complex in having a convex ramp below the suture on the left when viewed dorsally; in contrast, *N. robustum* is concave. The strong spiral incised uniform lines on the dorsum of *N. tasminae* are greatly reduced in *N. sowerbyorum*. Furthermore, *N. sowerbyorum* possesses an axial ridge on the shoulder not dissimilar, but less pronounced, to that on *N. robustum*. *Neodilatilabrum simanoki* is found in southern central Indonesia, and this includes the Kangean Islands (Liverani 2013). The author has examined a large sample (n = 146) of *N. sowerbyorum* from the Kangean Islands, and while no examples exactly match all the characteristics of the *N. simanoki* holotype, collectively they account for the variance, and therefore, *N. simanoki* is provisionally best placed within the synonymy of *N. sowerbyorum.* Morphological characteristics like the shape of the upper shoulder remain problematic.

The third, *N. succinctum* is found throughout the western and central Indo-Malaysian Province. In *N. succinctum* the height of the spire, which is often up to a third of the height of the shell and has later whorls that are sharply shouldered, and with well-defined sutures. This contrasts with *N. tasminae.* The new species, has later spire whorls that are finely and uniformly incised, being convex with a small raised spiral ridge at the point of maximum shoulder height.

The new taxa within the complex, *N. tasminae,* is known to range within Japonic Molluscan Province and into the neighbouring Philippinian Subprovince. Within the Japonic Molluscan Province, *N. tasminae* is recorded from the Ryukyuan and South China Subprovince. This species is stable in form, most variability is restricted to the shape, length and position of the posterior canal.

CONCLUSION

This paper introduces *N. tasminae* from Japan and brings the total of recognised species to six. *Neodilatilabrum simanoki* is provisionally placed within the synonymy of *N. soweryborum* based on shared characteristics. The *Neodilatalibrum* complex is one of dichotomies. Some taxa have a high degree of morphological stability such as *N. marginatum*, in contrast to other taxa, which are highly plastic in form such as *N. sowerbyorum.* This high degree of variability had historically led to taxonomic confusion. The development of a taxonomic key provides a means to differentiate specimens that have typical characteristics. The hypotheses presented in this paper seeks to explain the diversity within the Stromboideans and provides a definitive starting point from which to further explore the *Neodilatilabrum* for new taxonomic hypotheses.

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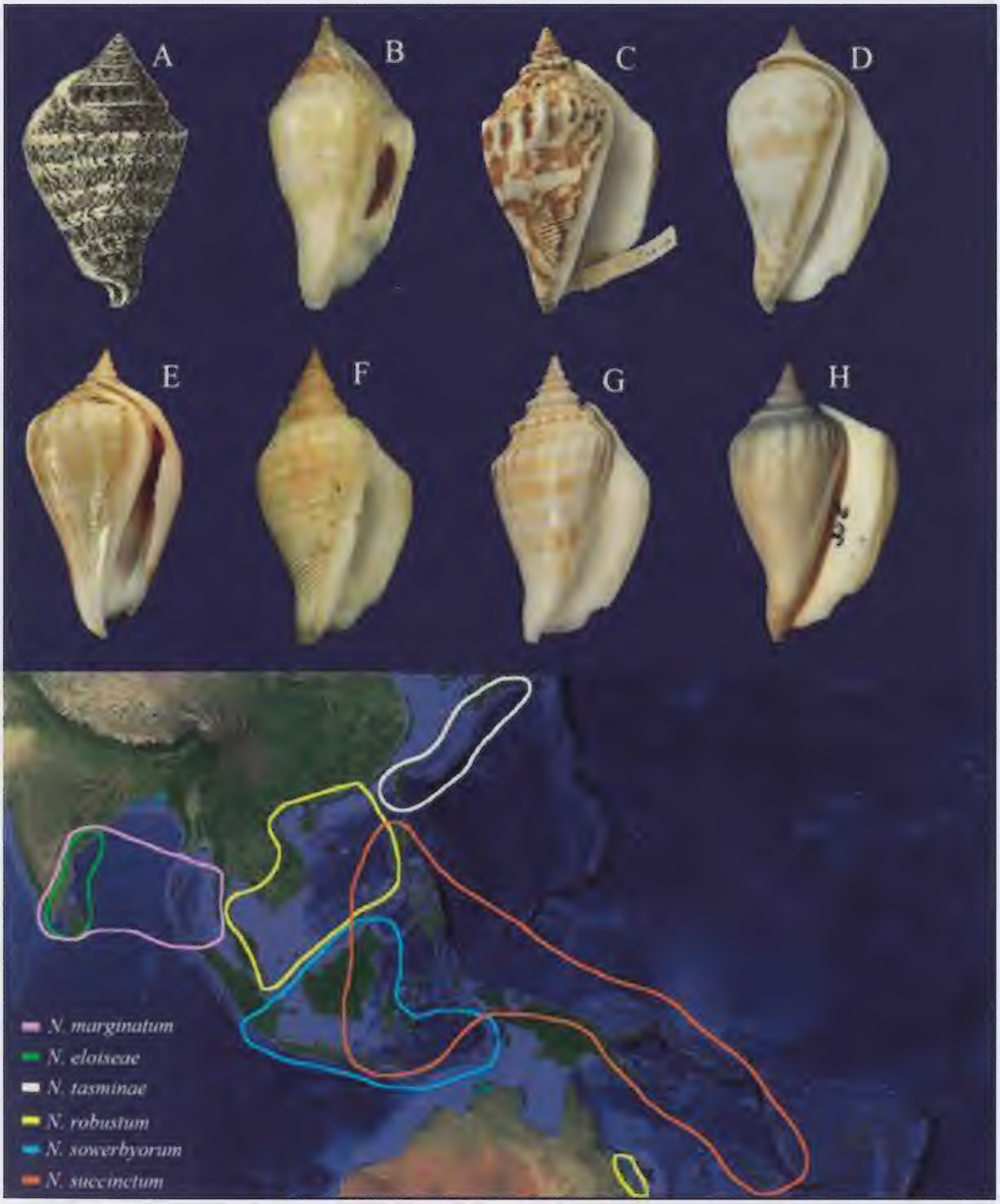

Figure 1. Types and distribution of taxa within the *Neodilatilabrum*: A= *Strombus marginatus* Linné, 1758, Neotype (Visser & Man in't Veld, 2005); **B**= *Margistrombus eloiseae* (Vertriest, 2022), Holotype (Vertriest, 2022); **C**= *Strombus robustus* Sowerby, 1875, Lectotype (Kronenberg *et al.* 2019); **D**= *Neodilatilabrum tasminae n. sp.,* Holotype 15986; **E**= *Strombus sowerbyorum* Visser & Man in 't Veld, 2005, Holotype (Kronenberg *et al.* 2019); **F**= *Strombus succinctus* Linné, 1767, Lectotype (Vertriest, 2022). **G**= *Margistrombus boucheti* Thach, 2016, Holotype (Kronenberg *et al.* 2019) [= *N. robustus* (Sowerby, 1875)]; **H**= *Margistrombus simanoki* Liverani, 2013, Holotype (Liverani 2013) [= *N. sowerbyorum* (Visser & Man in 't Veld, 2005)].

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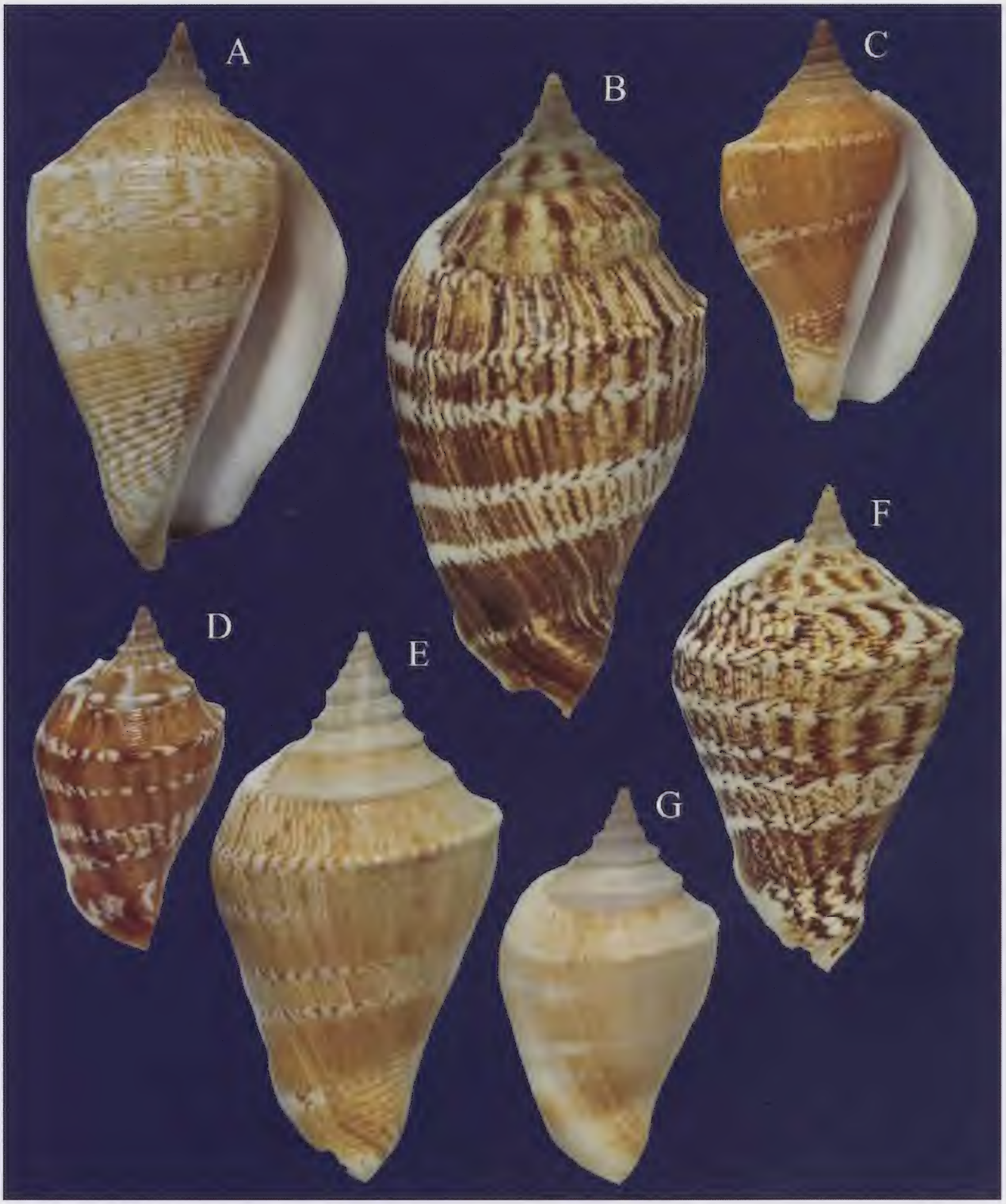

Figure 2. ***Neodilatilabrum marginatum*** **(Linné, 1758) variations in colour and form: A**= Kilarkaria, India, SMC 66.008f, 56 mm; **B**= Kilarkaria, India, SMC 66.008c, 56 mm; **C**= Kilarkaria, India, SMC66.008f, 41 mm; **D**= Kilakari, India, SMC 66.007c, 37 mm; **E**= Kilarkaria, India, SMC 66.003, 56 mm; **F**= Rameswaran, India, SMC 66.012, 50 mm; and **G**= Sri Lanka, SMC 66.010a, 41 mm.

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Figure 3. ***Neodilatilabrum eloiseae*** **(Vertriest, 2022) from Madras, India showing localised variability**: **A**= Paratype 21: Madras, 1982, SMC 70.001a, 47 mm; **B**= SMC 70.001i, 40 mm; **C**= Paratype 22: Madras, 1982, SMC 70.001b, 52 mm; and **D**= Paratype 23: Madras, 1982, SMC 70.001c, 54 mm.

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Figure 4. ***Neodilatilabrum robustum*** **(Sowerby, 1875) from Phan Theit, Vietnam illustrating the species localised variability: A**= SMC 68.008h, 44 mm; **B**= SMC 68.008i, 40 mm; **C**= SMC 68.008g, 43 mm; **D**= SMC 68.008d, 36 mm; **E**= SMC 68.008b, 35 mm; **F**= SMC 68.008a, 38 mm; **G**= SMC 68.008f, 43 mm; and **H**= SMC 68.008c, 40 mm.

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Figure 5. ***Neodilatilabrum sowerbyorum*** **(Visser & Man in't Veld, 2006) from the Kangean Islands of Indonesia illustrating the species high levels of localised intraspecific variability: A**= SMC 68a.002k, 40 mm; **B**= SMC 68a.002i, 51 mm; **C**= SMC 68a.002l, 30 mm; **D**= SMC 68a.002a, 39 mm; **E**= SMC 68a.002m, 37 mm; **F**= SMC 68a.002d, 40 mm; **G**= SMC 68a.002f, 31 mm; **H**= SMC 68a.010d, 41 mm; **I**= SMC 68a.010j, 36 mm; **J**= SMC 68a.010f, 35 mm; **K**= SMC 6a8.010i, 44 mm; and **L**= SMC 68a.002n, 30 mm.

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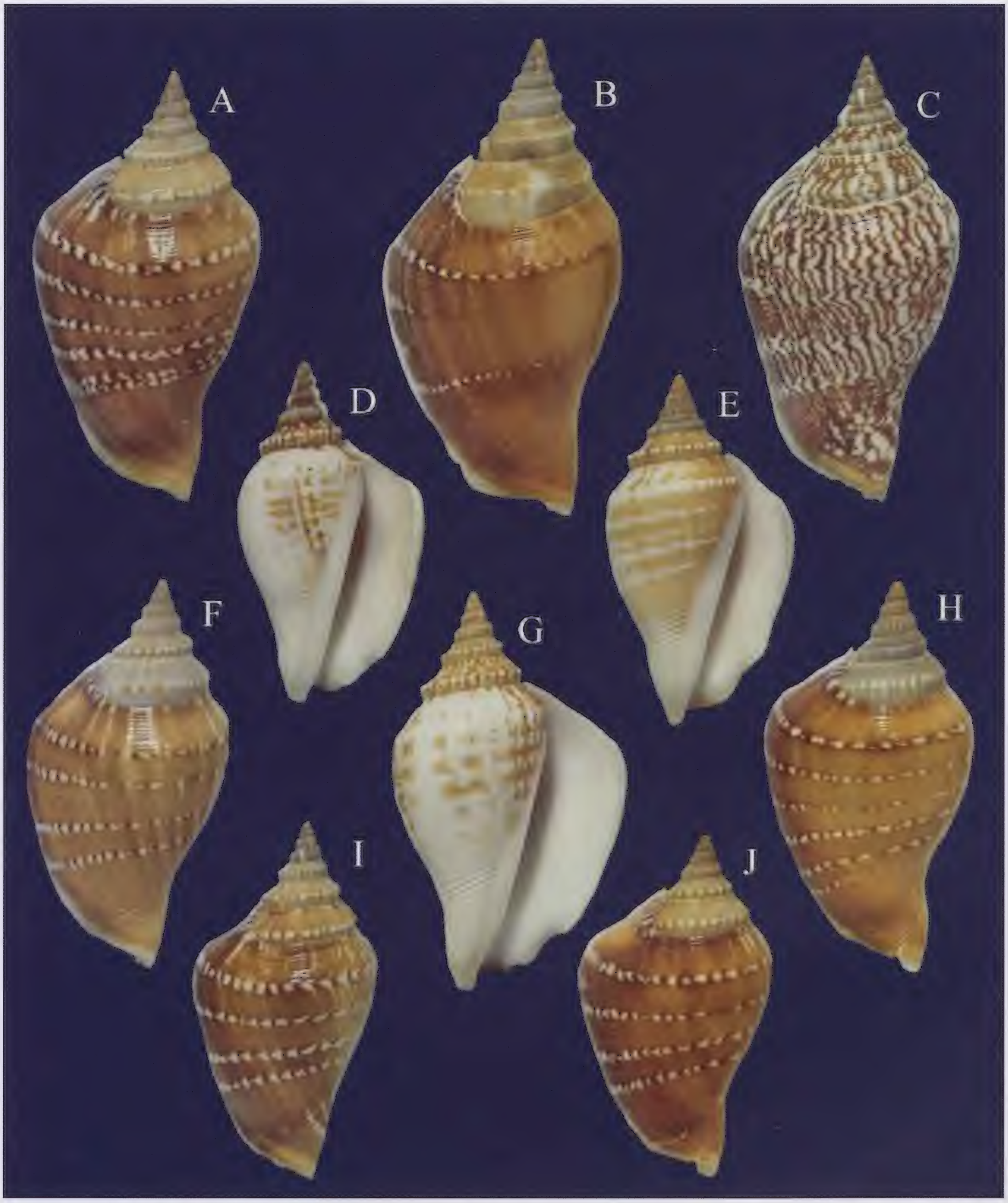

Figure 6. ***Neodilatilabrum succinctum*** **(Linné, 1767) variations from across the range showing variability: A**= Papua New Guinea, SMC 67.001a, 44 mm; **B**= Bilicasag Island, Philippines, SMC 67.002b, 49 mm; **C**= Solomon Islands, SMC 67.006b, 46 mm; **D**= Solomon Islands, SMC 67.003, 36 mm; **E**= Lunga River, Solomon Islands, SMC 67.004b, 39 mm; **F**= Papua New Guinea, SMC 67.001e, 40 mm; **G**= Papua New Guinea, SMC 67.001c, 41 mm; **H**= Papua New Guinea, SMC 67.001g, 40 mm; **I**= Papua New Guinea, SMC 67.001d, 39 mm; and **J**= Papua New Guinea, SMC 67.001b, 37 mm.

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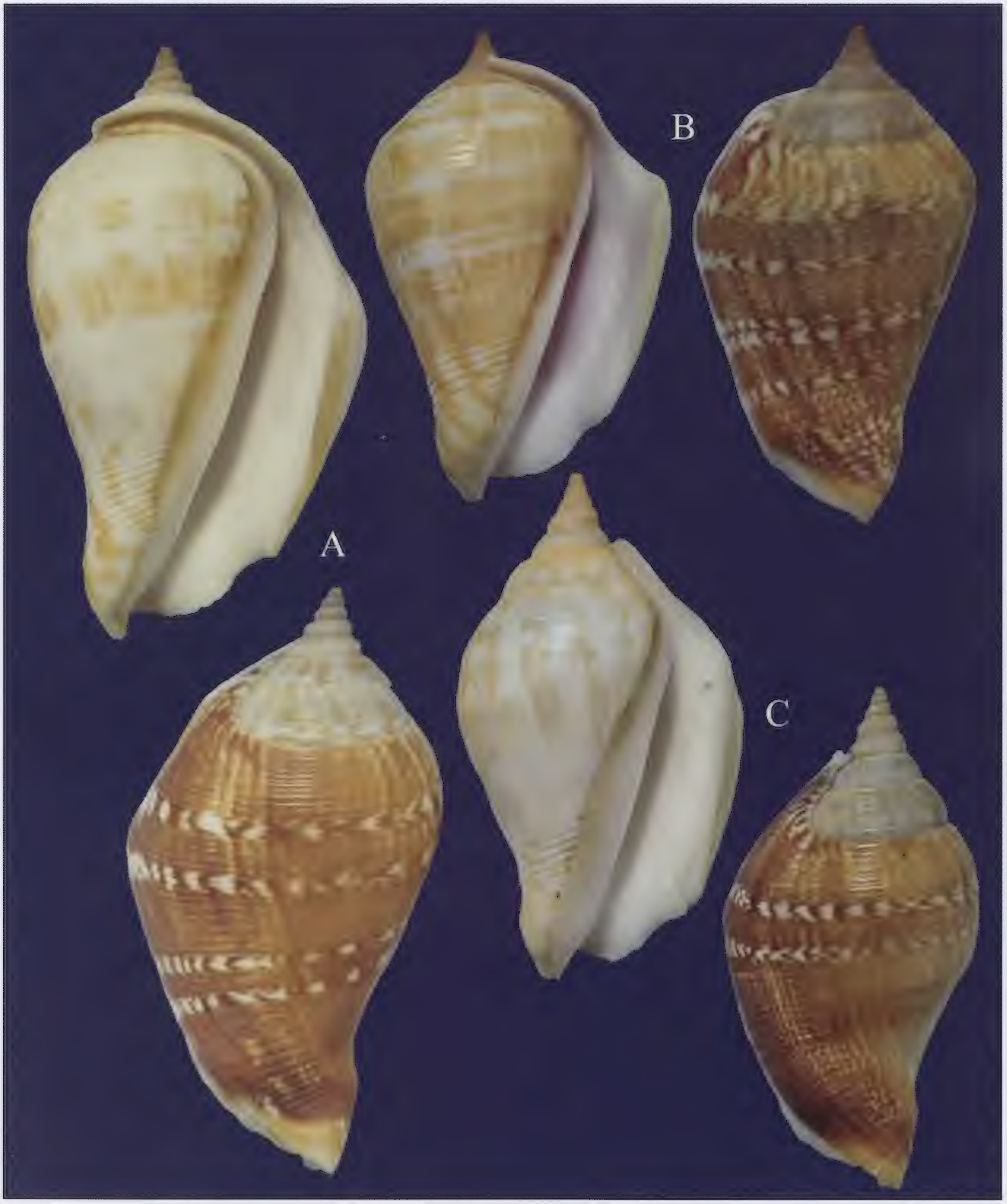

Figure 7. ***Neodilatilabrum tasminae n. sp.*** **type material: A**= Holotype: Okinawa, Japan, 1965, (TC008, exSMC 67a.008a), 61 mm; **B**= Paratype 1: Koninato, Japan, 2004, SMC 67a.001, 49 mm; and **C**= Paratype 2: Taiwan, 2000, SMC 67a.002, 52 mm.

ISSN 0738-9388

Figure 8. ***Neodilatilabrum tasminae n. sp.*** **type material: A**= Paratype 3: Okinawa, Japan, 1965, SMC 67a.003a, 64 mm; and **B**= Paratype 4: Okinawa, Japan, 1965, SMC 67a.003b, 60 mm.

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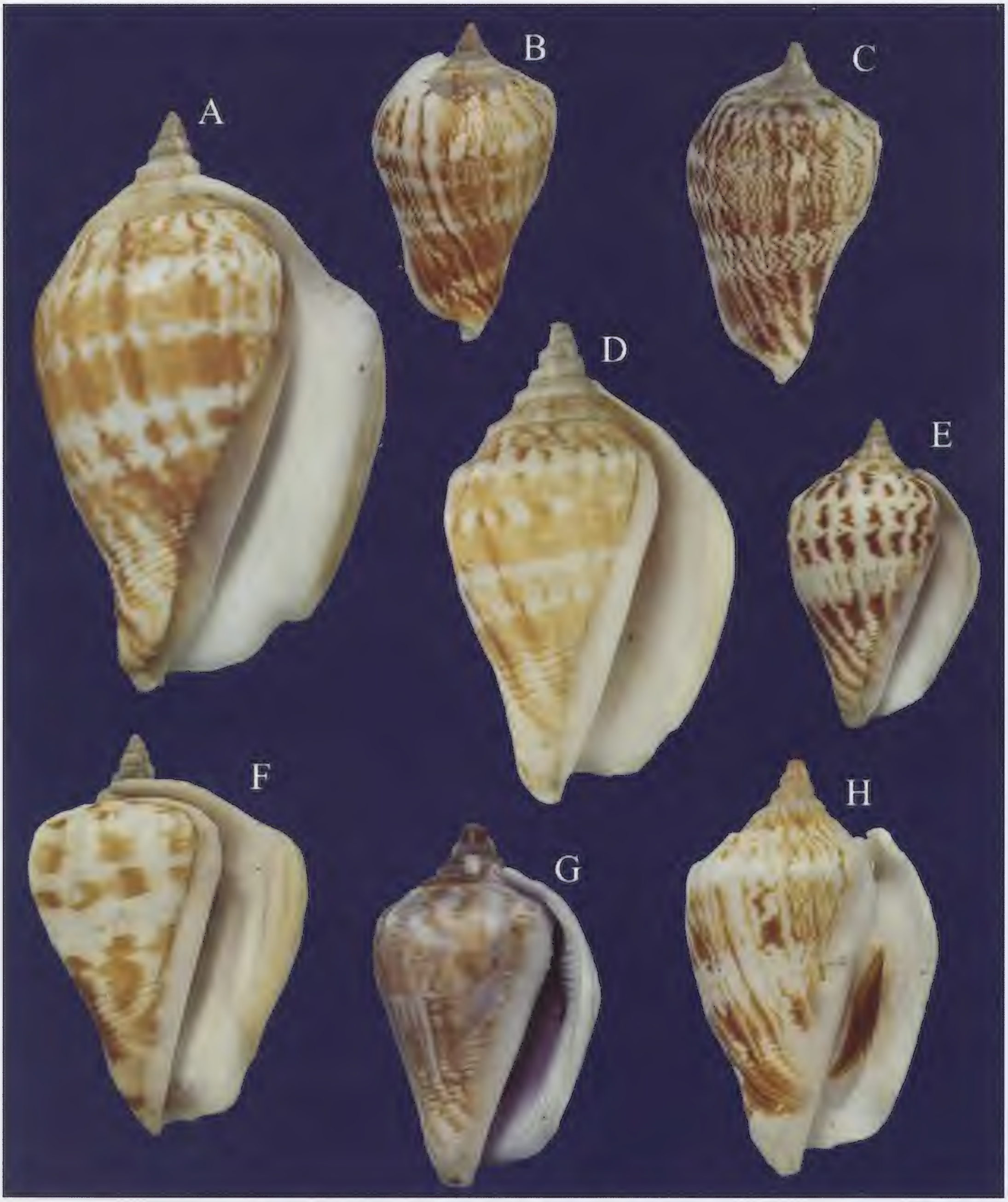

Figure 9. Comparative plate showing *Neodilatilabrum tasminae n. sp* and the variability of *N. robustum* (Linné, 1767) across its range. Note all *N. robustum* have a left axial ridge. *N. tasminae* type material herein: **A**= Paratype 5; Okinawa, Japan, 2005, SMC 67a.004, 59 mm. *N. robustum* material herein: **B**= East Coast of Thailand, SMC 68.006b, 33 mm; **C**= Endai, Johor, Malaysia, SMC 68.009b, 35 mm; **D**= Corregideo, Philippines, SMC 68.005c, 50 mm; **E**= East Coast of Thailand, SMC 68.006a, 32 mm; **F**= Indonesia, SMC 68.001, 41 mm; **G**= With purple aperture, SMC 68.0011, 38 mm; **H**= Dingo Beach Australia, SMC 68.004, 43 mm.

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Description of a New Species of *Darioconus* from Mozambique

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ABSTRACT A new species of *Darioconus* from Mozambique is described here, with comparisons to *Darioconus pennaceus* (Born, 1778), *Darioconus magnificus* (Reeve, 1843) and *Darioconus praelatus* (Hwass in Bruguierre, 1792).

KEYWORDS *Darioconus pennaceus*, *D. praelatus*, *D. paramagnificus*, Mozambique

INTRODUCTION

The taxon *Darioconus pennaceus* (Born, 1778) (Plate 2 Figures 5-6), has had a long, varied and convoluted history. Some 'markers' that elucidate this journey could begin with the then definitive book entitled Cone Shells (Walls 1979) at a time when species were being lumped together to the degree that he has no less than *D. omaria* (Hwass in Bruguiere, 1792), *D. rubiginosus* (Hwass in Bruguiere, 1792), *D. praelatus* (Hwass in Bruguiere, 1792), *D. episcopus* (Hwass in Bruguiere, 1792), and *D. aureus* (Roding, 1798) all in synonymy under *D. pennaceus*, making "species description" a real challenge. One comment that stands out is: "*Conus magnificus* is very similar to *C. pennaceus* in pattern, protoconch, blunt spire and general appearance". Many years have passed and there is still confusion and division in the cone world as to whether *pennaceus* and *praelatus*, both assumed to exist in Mozambique, are indeed separate species.

During this time of species agglomeration, Röckel, *et al.* produced the comprehensive Manual of the Living Conidae: Indo Pacific Region. 1995. Plate 63 therein is both revealing, and definitive. Figure 1 shows the lectotype of *pennaceus*, a broad, thick-set shell with a wide shoulder and relatively low spire. Figure 3 shows the Lectotype of *C. pennaceus f. praelatus*, pale, finer tenting, more cylindrical and higher spired. They also include like Walls, the following, in the "*pennaceus* basket": *D. rubiginosus* (Hwass in Bruguiere, 1792), *D. praelatus* (Hwass in Bruguiere, 1792), *D. episcopus* (Hwass in Bruguiere, 1792), *D. aureus* (Roding, 1798), as well as *D. elisae* (Kiener, 1846), *D. quasimagnificus* (da Motta, 1982), *D. bazarutensis* (Fernando & Montiero, 1988), *D. lohri* (Kilburn, 1972), and *D. ganensis* (Delsaerdt, 1988). These authors are clear on the distribution of *magnificus* (Reeve, 1843) as being from the central Philippines and eastwards. They also opine, that "*magnificus* is very similar to *episcopatus*". Their illustrations of lectotypes effectively remove previous assumptions of the appearance of *pennaceus* and *praelatus*.

Water flows under the malacological bridge and in 2010, Periera *et al.*, published "*Conus pennaceus*: a Phylogenetic analysis of the Mozambican Molluscan complex" in the African Journal of Marine Science. They mention that the "large morphological variability is exclusive to Mozambique" and Hawaii. They continue this conundrum, saying that it seems specimens co-habit with *Darioconus elisae* (this author agrees that this should be a full species) and *C. praelatus*. Their

ISSN 0738-9388

Figure 1 illustrates *D. amostra* 22 = *pennaceus*, *pemba*, and *D. amostra* 24 = *praelatus*. Of particular interest is Figure 3 where they introduce *D. episcopatus* (da Motta, 1982) into their phylogenetic derivation, and postulate that *pennaceus* (group), may have derived from *episcopatus*. This makes sense when one looks to the most up to date cone books, that illustrate the very broad/extensive Indo-Pacific range of *episcopatus*, relative to the smaller and totally separated areas occupied by *magnificus* and *pennaceus*. Their two images are in keeping with the continuing conchological paradigm, that *pennaceus* is broad and thick set, *praelatus* more cylindrical with higher spire. Puillandre *et al*. (2014), place as species, *episcopatus*, *magnificus*, and *pennaceus* under *Darioconus* as we head into the "era of species division". No mention by them is made of *praelatus*.

Xenophora Taxonomy 19 heralds a watershed moment in this journey. No less than Monnier, Tenorio, *et al.* (2018) work on Cones from Madagascar, Deep South. They introduce *D. praelatus* (with *D. vezoi* (Korn, Niederhöfer & Blöcher, 2000)), as full, separate and South Madagascar endemic species, different from *pennaceus*. They qualify the idea that the early author/s would have had access to such material as it is a shallow water species, and Fort Dauphin was en route to, and from Reunion, in the late 18th century.

And, so, in the huge and "re-defining " work of Monnier, Limplaer, *et al.* (2018), the malacological paradigm that has always been that *Darioconus praelatus* is a tented shell, rather more cylindrical than *pennaceus*, and critically, "also occurring in Mozambique", is properly challenged.

The amazing, commendable and massively comprehensive books of Living Conidae by Monnier, Limplaer, *et al.* (2018) brought in many changes, some of them sweeping, one of which, on page 955, is their confirmation of detective work that revealed *Darioconus praelatus* as being a native of Madagascar. Their multiple, fresh illustrations of this (full) species are clear, as they compare the once again illustrated lectotype with extremely similar fresher material from around Fort Dauphin, Madagascar. Pointed spire, light orange-brown 'background' and no definitive radial threads on the whorls. Their telling comment is that these Madagascan shells are "different from the shells from Mozambique".

The author has had in his possession for a considerable time, in excess of 17 puzzling shells, probably from the same gene pool, originally labeled as '*pennaceus*', from "Murungulu" (sic), (Morrungulo) "live taken in sand in crevices, 15 feet", during 1974 and has had the instinctive feeling that these shells do not fit a '*pennaceus* mould', and now, appear to be separate from *praelatus*, a Madagascan endemic. A fortuitous meeting with Manuel Amorim in Antwerp 2023 resulted in the acquisition of shells that are comparable to the "Morrungulo" material. The author surmised that this material bears a strong resemblance to *D. magnificus* as well as *D. episcopatus*, with the domed pink spire, cylinder-like shells, and beautiful pattern of "swirls" of fine tenting.

The logic/information of Monnier *et al.*, is hereby adopted, which means that many of the Mozambique shells that have for decades been referred to as '*praelatus*', require a formal name.

ABBREVIATIONS

Coll:	Collection of
n. sp.	New species
NMSA	KwaZulu Natal Museum

ISSN 0738-9388

MATERIAL AND METHODS

All specimens were photographed by Mark Page with a Canon 800D utilizing a dedicated photographic table with adjustable overhead arm. Lens utilized was a Canon 100 mm Macro lens. White LED photographic lamps were utilized for lighting with customized, in-camera white balance. Darktable elements were utilized to crop and orientate images.

SYSTEMATICS

Class	Gastropoda Cuvier, 1795
Subclass	Sobreoconcha Ponder & Lindberg, 1997
Order	Prosobranchia Milne-Edwards, 1848
Infraorder	Neogastropoda Wenz, 1938
Superfamily	Conoidea Fleming, 1822
Family	Conidae Fleming, 1822
Subfamily	Puncticulinae Tucker & Tenorio, 2009
Genus	*Darioconus* Iredale, 1930

Darioconus paramagnificus Aiken, new species
(Figure 1; Plate 1; Plate 2 A-D)

Figure 1. *Darioconus paramagnificus* n.sp. Holotype 46.8 x 22.8 mm. Donated to NMSA. (NMSA P2650/T4621)

Description. Shells range from 41 mm to 56 mm, averaging 49 mm, surface somewhat glossy, shells narrowly ovate with slightly curved sides. Shoulder distinct but not sharp. Spire of average height, fairly straight sided, apex domed, with tiny nipple like protoconch and pink teleoconch whorls. Aperture white within, pattern of whorl is of mainly fine, pale, sometimes bluish tenting set against chocolate to dark chocolate spaces, all in a distinctive "swirling" from suture to base. Dark areas of the whorl are not solid in colour. In some shells, a vague spiral banding may be discerned. Body whorl is not smooth, but consists of a series of close set shallow spiral bands or threads, slightly stronger anteriorly, continuing all the way up to the shoulder. These bands are punctuated by fine white spotting.

Type Material. The type material of the holotype and paratypes of *Darioconus. paramagnificus* are as follows:

Holotype *Darioconus paramagnificus* n. sp. (46.8 x 22.8 mm). (Figure 1, Plate 1A). Coll: NMSA P2650/T4621. Live taken in Memba, Mozambique. Donated by R. Aiken.

Paratype 1 *D. paramagnificus* n. sp. (54.9 x 24.7 mm). (Plate 1B). Live Memba, Mozambique. Coll: R. Aiken.

Paratype 2 *D. paramagnificus* n. sp. (49.4 x 22.7 mm). (Plate 1C). Live Memba, Mozambique. Coll: R. Aiken.

Paratype 3 *D. paramagnificus* n. sp. (56.6 x 27.4 mm). Live Memba, Mozambique. Coll: D. Berschauer.

Paratype 4 *D. paramagnificus* n. sp. (53.2 x 23.9 mm). (Plate 1D). Live Memba, Mozambique. Coll: R. Aiken.

Paratype 5 *D. paramagnificus* n. sp. (59.1 x 27.7 mm). (Plate 1E). Live Memba, Mozambique. Coll: R. Aiken.

Paratype 6 *Darioconus paramagnificus* n. sp. (58.4 x 28.1 mm). Memba, Mozambique. Coll: M. Page.

ISSN 0738-9388

Paratype 7 *D. paramagnificus* n. sp. (49.6 x 25.3 mm). (Plate 1F). Morrungulo, Mozambique. Coll: R. Aiken.
Paratype 8 *D. paramagnificus* n. sp. (52.5 x 25.4 mm). (Plate 2A). Morrungulo, Mozambique. Coll: R. Aiken.
Paratype 9 *D. paramagnificus* n. sp. (50.9 x 24.7 mm). (Plate 2B). Morrungulo, Mozambique. Coll: R. Aiken.
Paratype 10 *D. paramagnificus* n. sp. (49.6 x 22.5 mm). (Plate 2C). Morrungulo, Mozambique. Coll: R. Aiken.
Paratype 11 *D. paramagnificus* n. sp. (45.2 x 20.9 mm). (Plate 2D). Morrungulo, Mozambique. Coll: R. Aiken.
Paratype 12 *D. paramagnificus* n. sp. (41.5 x 20.9 mm). (Morrungulo, Mozambique. Coll: R. Aiken.
Paratype 13 *D. paramagnificus* n. sp. (42.2 x 20.4 mm). Morrungulo, Mozambique. Coll: R. Aiken.
Paratype 14 *D. paramagnificus* n. sp. (56.2 x 25.2 mm). Memba, Mozambique. Coll: M. Amorim.

Type Locality. Memba, Mozambique.
Distribution. From Memba southwards to presumably an area around Morrungulo, north of Inhambane.
Etymology. This species has a distinct combination of many of the features seen in *D. magnificus*.

DISCUSSION

A number of authors have alluded to the similarities between what has been called *D. praelatus/pennaceus*, and that of *D. magnificus* and *D. episcopatus*. The information on *praelatus* presented by Monnier, Limplaer, *et al.* (2018) seems conclusive. Add to this, the phylogeny of Periera *et al.* (2010) that *episcopatus* could easily be the 'parent' of these Mozambique shells, and it becomes clear that the above description is warranted.

ACKNOWLEDGEMENTS

Thanks to Mark Page, for photographic images, document preparation and advice, to Nelisiwe Manukuza, KwaZulu-Natal Museum, for prompt supply of accession number. Special thanks to Manuel Amorim for material supplied for this study, and to Edward J. Petuch for his sage wisdom and advice.

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Volume: 55 THE FESTIVUS ISSUE 3

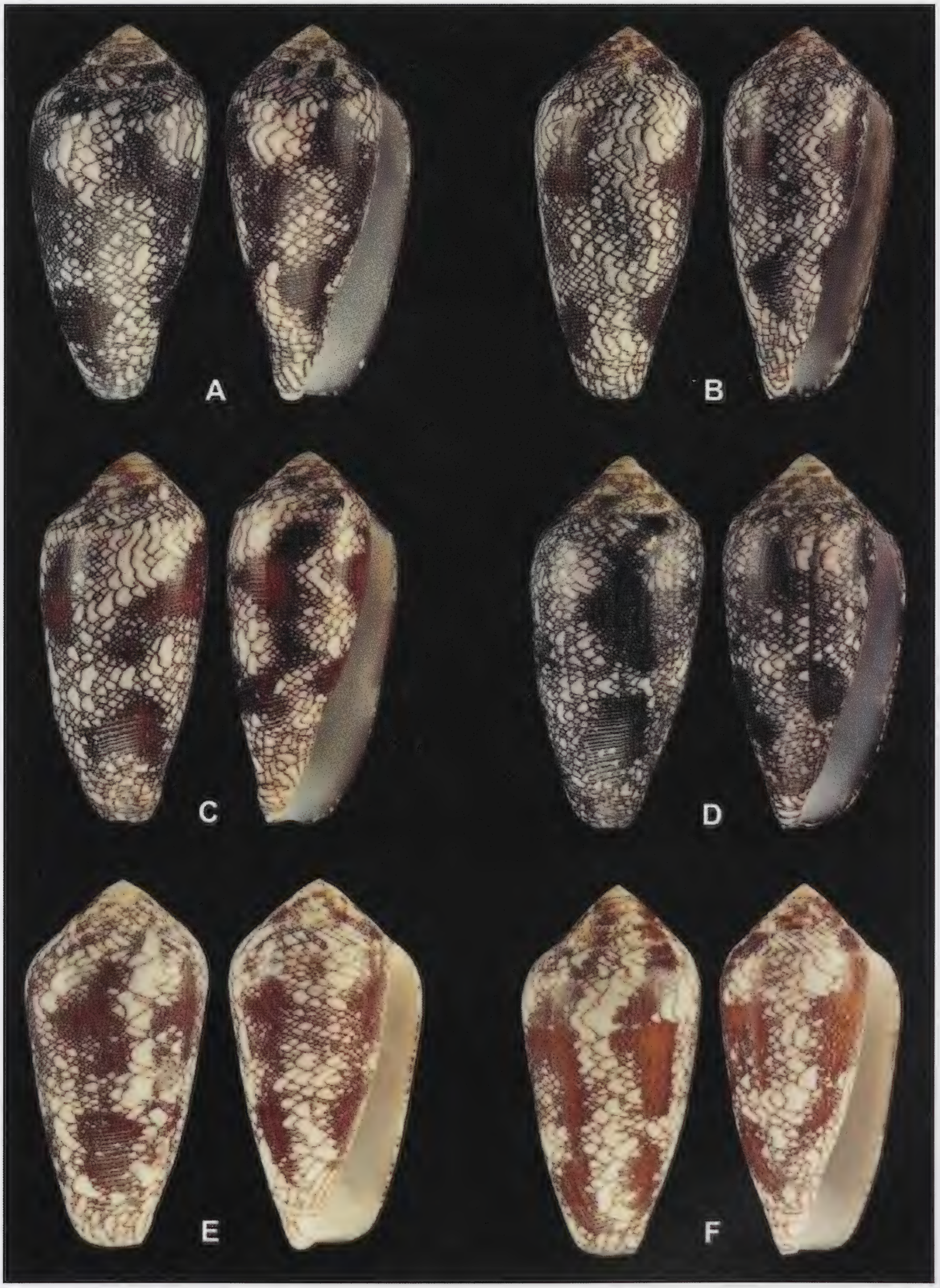

Plate 1. A= *Darioconus paramagnificus* n. sp. Holotype (NMSA P2650/T4621) (46.8 x 22.8 mm), Memba, Mozambique. **B**= *Darioconus paramagnificus* n. sp. Paratype 1 (54.9 x 24.7 mm), Memba, Mozambique. **C**= *Darioconus paramagnificus* n. sp. Paratype 2 (49.4 x 22.7 mm), Memba, Mozambique. **D**= *Darioconus paramagnificus* n. sp. Paratype 4 (53.2 x 23.9 mm), Memba, Mozambique. **E**= *Darioconus paramagnificus* n. sp. Paratype 5 (59.1 x 27.7 mm), Memba, Mozambique. **F**= *Darioconus paramagnificus* n. sp. Paratype 7 (49.6 x 25.3 mm), Morrungulo, Mozambique.

ISSN 0738-9388

Plate 2. A= *Darioconus paramagnificus* n. sp. Paratype 8 (52.5 x 25.4 mm), Morrungulo, Mozambique. **B**= *Darioconus paramagnificus* n. sp. Paratype 9 (50.9 x 24.7 mm), Morrungulo, Mozambique. **C**= *Darioconus paramagnificus* n. sp. Paratype 10 (49.6 x 22.5 mm), Morrungulo, Mozambique. **D**= *Darioconus paramagnificus* n. sp. Paratype 11 (45.2 x 20.9 mm), Morrungulo, Mozambique. **E**= *Darioconus pennaceus* (45.6 x 23.2 mm), Mozambique, Coll: R. Aiken. **F**= *Darioconus pennaceus* (37.2 x 20.4 mm), Mozambique, Coll: R. Aiken.

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A New Genus and Species of Chiton from the Aleutian Islands

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ABSTRACT An unusual new genus and species of chiton, *Boreacanthus griphus* n. g. & n. sp. is described from the shallow subtidal depths of the central Aleutian Islands, and is tentatively placed in the family Mopaliidae Dall, 1889. The tail valve of the new taxon has a caudal sinus typical of the family Mopaliidae, but differs from all other known members of Mopaliidae in possessing pustulose tegmental sculpture and spike-like, calcareous girdle elements.

KEY WORDS Chiton, Mopaliidae, Polyplacophora, *Boreacanthus griphus*, new genus, new species, Aleutian Islands

INTRODUCTION

The Aleutian Island archipelago is one of the most remote and inaccessible regions in the world (Map 1). The chiton fauna of the Aleutians has been poorly studied, with few published accounts, but is presently the subject of review (Clark, in prep.). Dall (1921) listed 27 species of chitons as occurring the Aleutians, Baxter (1987), listed just 25 species from the region, Vermeij, *et. al.* (1990), reported nine shallow water (0-12 m) species from throughout the chain, and O'Clair (1977), reported finding eight shallow water (0-37 m) species in a survey of Amchitka Island, but little else has been published. During recent SCUBA surveys in the region, aboard the R/V Norseman (AKMAP 2006-2007, ACRA 2008, AIMP 2011), several hundred chiton specimens were collected at depths of 1-18 m, from more than thirty islands, throughout the chain. This collection included two specimens of an enigmatic species with pustulose valves and calcareous spines on the girdle. which resembles a species of *Chaetopleura* or some members *Lepidochitona,* however the tail valve has a caudal sinus, a feature of the family Mopaliidae. *Boreacanthus griphus* Clark, n. gen. and n. sp. is described herein, and tentatively placed in the family Mopaliidae Dall, 1886, following the diagnosis of Kaas & Van Belle (1994).

ABBREVIATIONS

AIMP, U. S. Department of Energy, Amchitka Island Monitoring Program.
AKMAP, Alaska Monitoring and Assessment Program, 2006-2007.
AKALE07, AKMAP 2007 station, Aleutian Islands, 2006-2007.
ACRA, Aleutian Coralline Red Algae Expedition, 2008.
LACM, Natural History Museum of Los Angeles County.
RNC, Reference collection of R.N. Clark.
SBMNH, Santa Barbara Museum of Natural History.

METHODS

From 2006-2011 (AKMAP, ACRA & AIMP), several hundred samples of chitons were hand collected by the author, using SCUBA, from shallow (1-18 m) depths throughout the

ISSN 0738-9388

Aleutian Islands (report in progress). The specimens were flattened and preserved in 80% Ethanol. High resolution images were taken of the valves and girdle by Anthony Draeger, using a photo stacking program. Radulae were imaged with the Scanning Electron Microscope at the Santa Barbara Museum of Natural History by Dr. Daniel Geiger.

Boreacanthus new genus

Diagnosis. Small chitons (to about 13.2 x 8.0 mm), broadly oval, moderately elevated; valves randomly covered with small (350 to 500 μm in diameter) pustules; articulamentum with typically seven slits; Intermediate valves roughly quadrate, lateral areas poorly defined, pustules on lateral areas closer together, sutural laminae fairly broad, single slitted, jugal laminae lacking except in tail valve; tail valve with a caudal sinus, and jugal lamina with slits on either side; insertion slits short or lacking; Girdle relatively broad, about half of intermediate valve five tegmentum width, evenly beset with calcareous spicules, much larger spicules in tufts at valve sutures, and at the girdle margin; Ctenidia; merobranchial, abanal. Radula with large, tri-cuspid major laterals.

Remarks. ***Boreacanthus*** differs from all other Mopaliidae in 1), the absence or weakly indicated slits of the insertion plate of the tail valve, 2), the pustulose valve sculpture, and 3), spiculose girdle elements.

Type Species. ***Boreacanthus griphus*** Clark, sp. nov.

Etymology. Greek, *boreios*, "northern" & *akanthos* "prickly".

Boreacanthus griphus Clark, new species
(Figures 1-9)

Description. Small chitons, to 13.2 mm (paratype), holotype 10.5 x 7.0 mm (Figure 1), broadly oval, moderately elevated (2.25 mm in Holotype) side slopes straight; tegmentum of valves pustulose, pustules about 35 μm in diameter; eaves spongy; articulamentum white, with tegmental color showing through; color of valves uniformly light brick-red to burnt orange; girdle yellowish tan dorsally, white ventrally.

Head valve (Figure 2), semi-circular, posterior margin widely v-shaped, width 3.2 mm, margins slightly thickened; pustules randomly spaced; articulamentum, holotype with six slits (due to two central insertion teeth being fused together), paratype with seven slits, insertion teeth; teeth long, smooth. **Intermediate valves** (Figure 3), roughly sub-quadrate, tegmentum slightly more than twice as wide as long, valve five tegmentum 4.0 mm in width, slightly beaked; central areas pustules set one to two diameters apart; lateral areas poorly defined, pustules set one diameter or less apart; sutural laminae quite long (about 1/3 tegmentum length), rounded, with one slit per side; jugal laminae absent; insertion plates with a single slit.

Tail valve (Figure 4), tegmentum 2.5 mm in width, roughly trapezoidal, mucro about 20% of distance from posterior margin, post mucronal area swollen, slope straight; pustule distribution similar to intermediate valves, those of the post-muscronal area closer together than those of the antemucronal area. Insertion plate with 0 to one slits per side. The two type specimens contrast in this character, in that the holotype lacks slits, but the paratype has one short slit per side. This variability is seen in *Cryptochion stelleri* as well, which occasionally lacks slits in the tail valve.

Aesthetes (Figure 5), megalaesthetes, one atop of each tegmental granule, roughly circular, approx. 10 μm in diameter, microaesthetes scattered about shell surface, slightly smaller in diameter than megalaesthetes. **Girdle** (Figures 6 & 7), relatively broad, somewhat less than half the width of valve five tegmentum, wider at sides than at ends; dorsal surface (Figure 6), densely clothed with smooth, sharp, bent

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spicules, to about 200 μm in length, longer, nearly straight or slightly curved spicules, to about 1.0 mm around the margin, and in tufts of three or four at valve sutures; ventral surface (Figure 7), densely covered with bluntly pointed, outwardly directed spicules, about 75 μm in length. **Ctenidia** (Figure 8), merobranchial, abanal, extending a little more than one half of foot length; 13 gills per side. **Radula** (Figure 9), typical mopaliioid, with large tri-cuspid major lateral teeth, about 250 μm in length, cusps bluntly pointed; rachidian tooth long, tongue shaped, about 100 μm in length, with a medial ridge; minor laterals with broadly triangular base, and slender upper half; spatulate uncinal teeth narrow, only moderately expanded distally, nearly as long as major laterals; outer uncinal teeth flattened, roughly diamond shaped; marginal teeth pentagonal, distal side longest, flattened, slightly thickened, pointed medial on the proximal side.

Type Locality. Bay of Islands, west side of Adak Island, Andreanof Islands, Aleutian Islands, Alaska (51°49.02' N, 176°50.38' W), 16 m on side of boulder (*leg.* Roger N. Clark, 9 July, 2007) (AKALE07-0005).

Type Material. Holotype SBMNH 184006, 10.5 x 7.0 mm (ex-RNC 2338); Paratype LACM 3798, Hawadax Island, Rat Islands, Aleutian Islands, Alaska (51°48.54' N, 178°19.87' E), 12 m, on bedrock (*leg.* Roger N. Clark, 8 June, 2008), 13.2 x 8 mm. (ex-RNC 2394) (ACRA08-7).

Distribution. Known so far only from the central Aleutian Islands, from Adak Island, Andreanof Is., to Hawadax Island, Rat Is. 176°50' W to 178°19' E. (Map 1).

Habitat. Bedrock and boulders encrusted with the, crustose coralline red algae *Clathromorphum nereostracum* Lebednik, 1977, and others, and various encrusting invertebrates, at depths of 12-16 m.

Etymology. *griphus,* Latin, griphus "riddle, mystery", a singular noun in the nominative case used in apposition.

Discussion. *Boreacanthus griphus* is apparently a rare or very cryptic species, as only two specimens have been collected so far, despite much searching at Adak and Amchitka Islands (AIMP, 2011). The new taxon is tentatively placed in Mopaliidae based upon the family diagnosis in Kaas and Van Belle (1994), particularly the caudal sinus in the articulamentum of the tail valve, but it is unique amongst the Mopaliidae in its randomly pustulose sculpture and ill-defined lateral areas. The new taxa resemble members of the chiefly southern hemisphere genus *Plaxiphora* Gray, 1847, which lacks slits in the tail valve, and has diverse girdle ornamentation, including calcareous spines. It also has affinities with *Cryptochiton* Middendorff, 1847, which also sometimes lacks slits in the tail valve, and has tufts of minute calcareous spicules.

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Map 1. Aleutian Islands. Red star, indicates the type locality, red circle, paratype site.

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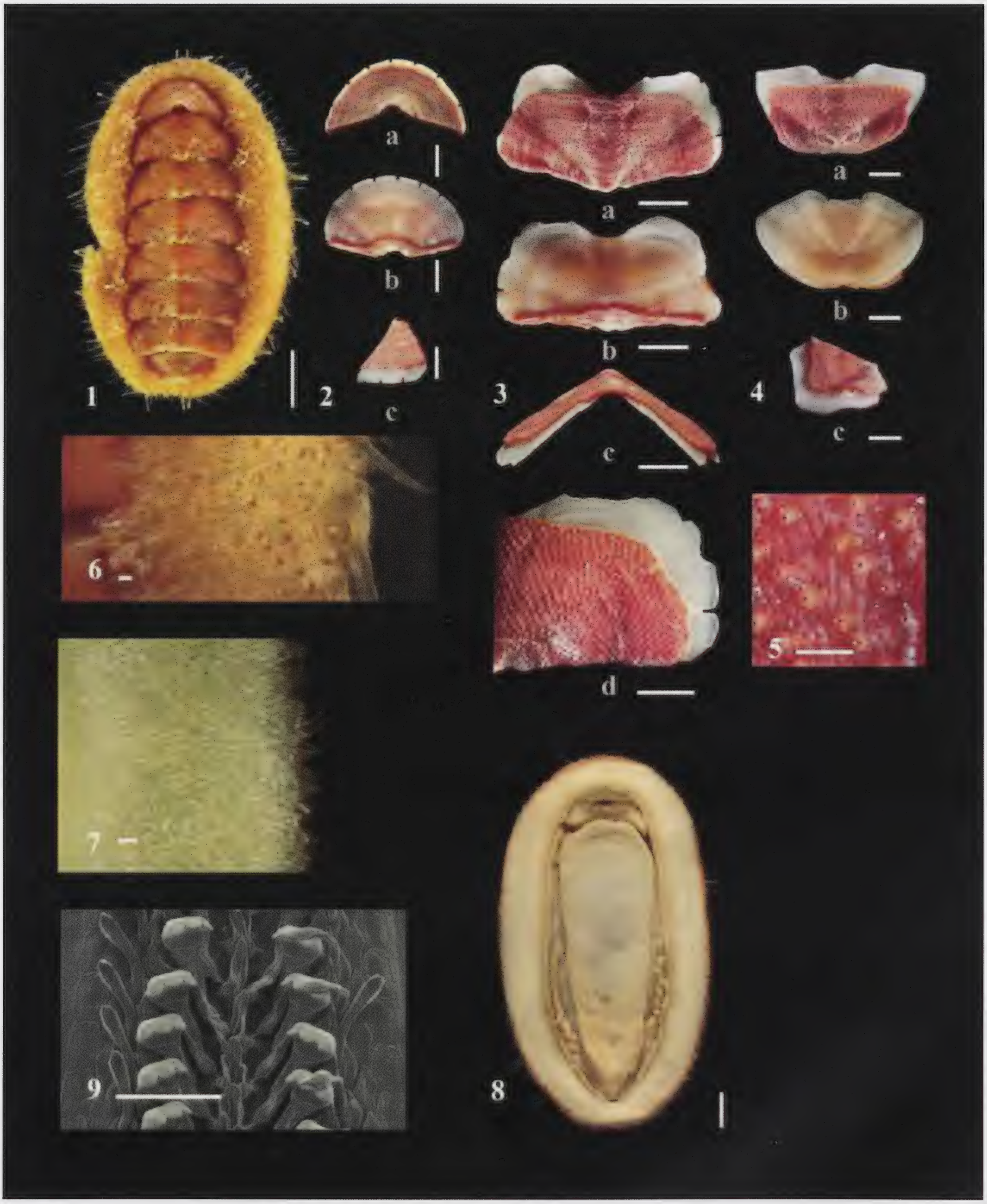

Figures 1-9. ***Boreacanthus griphus*** **n. sp.** Holotype**, 1, 3-7, 9** (SBMNH 184006); Paratype, **2**,**8**; Figure **1**= whole animal, dorsal view, bar = 2 mm; Figure **2**= head valve, bars equal 1 mm; Figure **3**= Intermediate valve V, bars = 1 mm; Figure **4**= tail valve, bars = 0.5 mm; Figure **5**= close-up, 300 μm square of tegmentum, showing aesthetes, bar = 100 μm; Figure **6**= Dorsal surface of girdle, showing dorsal and marginal spicules, bar = 100 μm; Figure **7**= Ventral surface of girdle, showing ventral spicules, bar = 100 μm; Figure **8**= whole animal, ventral view, bar = 1 mm; Figure **9**= Radula, bar = 200 μm.

ISSN 0738-9388

Volume: 55 THE FESTIVUS ISSUE 3

Have a shell collection you would like to donate to The San Diego Shell Club?

The San Diego Shell Club is interested in your shell collection. As a 501c(3) organization, all donations to our Club may provide a tax write-off. When we receive a donation we provide a letter describing the items that may be used when filing your taxes. While we cannot provide a value, donations of up to $5,000 do not require a written appraisal. Since tax laws change regularly we recommend that you check with your tax accountant before relying on any information provided here.

We are interested in all types of shells, marine or land and all genera and species, including books on shells as well as items related to shells such as artwork, storage cases and tools. Your donated items will be used to generate income to support the Club's efforts in continuing Public education about shells and conservation of marine life throughout the world. If you would like to donate, please contact David Waller, SDSC Acquisition Chairperson, by email at dwaller@dbwipmg.com to schedule a time to discuss charitable gifting.

CLUB NEWS

May 2023 - On May 20th, the Club's General Meeting was a lively Zoom presentation by Stephen Maxwell on "Strombs of Australia and Beyond". A link to the video recording of the presentation may be found on the Club's website. https://us02web.zoom.us/j/81260754836?pwd=WXh5T2orRmpCWV FjdHFwRU9qUituUT09

June 2023 - On June 17th, the Club held an in person General Meeting with a social gathering and mini-auction at the home of Larry and Toni Buck. Some beautiful shells from the Scott Martin Legacy Collection were sold at auction, Club members brought shells for sale, and there was some "show and tell". A fun time was had by all.

July 2023 - On July 15th, the Club held the first Shell Bazaar in several years after being repeatedly canceled due to the pandemic. The event was held at Larry and Toni Buck's home, and the Club is grateful for their generosity in hosting so many events this year. There was a mini-auction and a variety of shells were available for sale, as well as beautiful specimens on display from members' private collections.

ISSN 0738-9388

Volume: 55 THE FESTIVUS ISSUE 3

Modeling Mollusks

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I have always been interested in the natural world and have written books, done paintings, and have enjoyed making models to recreate organisms in 3-dimensional space. My modeling, both for myself and museums, has spanned a wide range of organisms from invertebrates to fish, birds, and mammals. The largest models I have made are a six-foot whale shark, with divers on the pectoral fins, and a beautiful six-foot coelacanth. Fortunately, most models of present-day mollusks are rather small. As ocean conditions change due to both warming and acidification, modeling becomes even more relevant.

I have had a long interest in gastropods and been a member of the San Diego Shell Club for over 45 years. Within the gastropods, I have always had an appreciation for the diverse and colorful marine slugs (opisthobranches). My goal in this short note is to encourage those interested in adding a new dimension to their collections by modeling the live part of these organisms.

Why modeling? For many, it's something new to learn and step into. You have the chance to express your creativity and use your hands and mind. Models document the animal, the diverse morphology, and biological adaptions. Models can be used as a teaching tool and inspire young minds, or to add a new dimension to your collection. Slugs (terrestrial or marine) and shelled gastropods lose both their body shape and color when preserved. Imagine having a draw full of colorful nudibranchs in your collection. It could be a regional collection or worldwide. In addition, modeling works just as well for shelled gastropods. Plus, modeling is a perfect activity to pursue during the pandemic and afterwards. In a recent copy of the American Conchologist (2020, vol 49(1)18-23), Mike Sanchez discusses the development of a new display of current and past Mollusks that were modeled and used to display organisms in their entirety.

Don't be discouraged if your first attempts are not perfect, just think of how many times you fell off your first bike before you were really accomplished. You might turn a hobby into a business sculpting the shells soft parts to complete the life-history of the snail. You can also create a natural underwater setting to display your work.

In some ways marine and terrestrial snails (slugs) that lack external shells are easier to start with. As long as they are modeled to the correct proportions, and can easily be made many times larger than life, and therefore are easier to work on and, in some ways, have more presence in a display.

Some, such as Hopkins' Rose (*Okenia rosacea*) (Figure 1), are attractive but complicated by all of the gills. Starting with a dorid type critter will build your experience with the clay and coloration.

The body of shelled gastropods must be scaled in size to fit the shell. You build the animal and then make an appropriate raised area so that the shell can rest securely on top of the model. Figure 2 is a large California whelk (*Kelletia kelletii*) with a removable shell. The ability to removed the shell can help for storage or transport. Label both the shell and model so that the two can be reunited for another display.

ISSN 0738-9388

While building your model, think about where attachments might be placed later, such as an operculum, tentacles, eye stalks, gills or rhinophores. On-line images of live animals would be a good place to start your project and you can determine the colors that will be needed to complete your project.

The clay I suggest is SCULPY ® found in art supply stores. A variety of colors can be mixed to duplicate the color of the mollusk's body, or your model can be painted afterwards. When you feel satisfied with your design and the clay is still soft, if it is a shelled gastropod, make sure the shell nests properly upon your handy work, then remove the shell and heat the model in the oven according to instructions on the package. After heat curing, let it cool then place the shell upon the model you created to ensure it fits properly. Then, remove the shell and add any additional parts, and color according to the photos of the live animal.

Alternatively, the clay could be a water based clay. Do the same to shape the snails' lifelike body and let dry and then paint with oil, acrylic, or watercolors. The bodies of the animals of the Volute family are as colorful as the sea-slugs.

Another practice clay could be as simple as a mixture of white flower and a good amount of salt and some warm water to make a dough that can be kneaded into different shapes, air dried and later sealed and painted. Then mount the sea shell or terrestrial snail's shell upon your creation. Remember, the eye stalks of marine snails can move independent of each other, looking in two different directions at same time.

I have not used a 3 D printer and scanner. That option has a notable price tag, but if an institution already has the technology, then it would be worth looking into this option. There is less creativity involved, but may be fun for those with access to the equipment and who are not technically challenged.

I hope you enjoy your handy work and the more you practice this rewarding hobby, the more proficient you will become.

Figure 1. Hopkins' Rose

Figure 2. California whelk

ISSN 0738-9388

Volume: 55 THE FESTIVUS ISSUE 3

Clapping Clams: *Limaria pacifica* in its Happy Place

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Clams seem to be a happy lot, according to the old saying. However, one finds it hard to really detect if they have any emotion. Well, how about flapping around when disturbed by a rock roller? Are they upset that their peace has been disrupted? Are they flapping to threaten a disturbing troublemaker, or are they fleeing to escape a possible predator?

Now, I am certainly not anthropomorphizing clams (although I know a few clamophilic folks who would like to). But there are a few groups of clams known for their ability to "clap" their shells open and shut and at least propel themselves into the water column. Among this group can be included the majority of the 130 known living species of Limidae. They can occur in nests under rocks and are capable of active, irregular swimming by clapping their valves and waving their long, colorful mantle tentacles. They can swim backwards or forwards by changing the direction of the water-jet discharge (Bertsch & Aguilar Rosas, 2016). Further details on their swimming can be found in Mikkelsen & Bieler, 2003, and Merrill & Turner, 1963. In addition to aiding swimming, the sticky tentacles of Limidae may make them unpalatable to fish, since they readily break loose when disturbed and entangle in the predator's mouth (Bertsch & Aguilar Rosas, 2016).

During my years of field research (Bertsch, 2019) at Bahía de los Ángeles and elsewhere throughout the Gulf of California, I have encountered slightly more than a dozen living individuals of *Limaria pacifica*. When a rock has been rolled, exposing the Limidae species' nest in a small space, the animal nearly always began to swim. I've been rather impressed by this animal and its behavior, and I present here information on this species and some images of the living animal in all its splendor.

Limaria pacifica occurs from the northern Gulf of California (Puerto Peñasco, Sonora, and San Felipe, Baja California) to Bayovar, Piura, Perú. Ten reported species of Limidae occur in the tropical eastern Pacific:

Acesta agassizii (Dall, 1902)
Acesta diomedea (Dall, 1908)
Acesta mori (Hertlein, 1952) (see Walz *et al.*, 2014)
Acesta sphoni (Hertlein, 1963) (see Walz *et al.*, 2014)
Lima tetrica Gould, 1851
Limaria hemphilli (Hertlein & Strong, 1946)
Limaria orbignyi (Lamy, 1930)
Limaria pacifica (d'Orbigny, 1846)
Limatula saturna Bernard, 1978
Limatula similaris (Dall, 1908)

ISSN 0738-9388

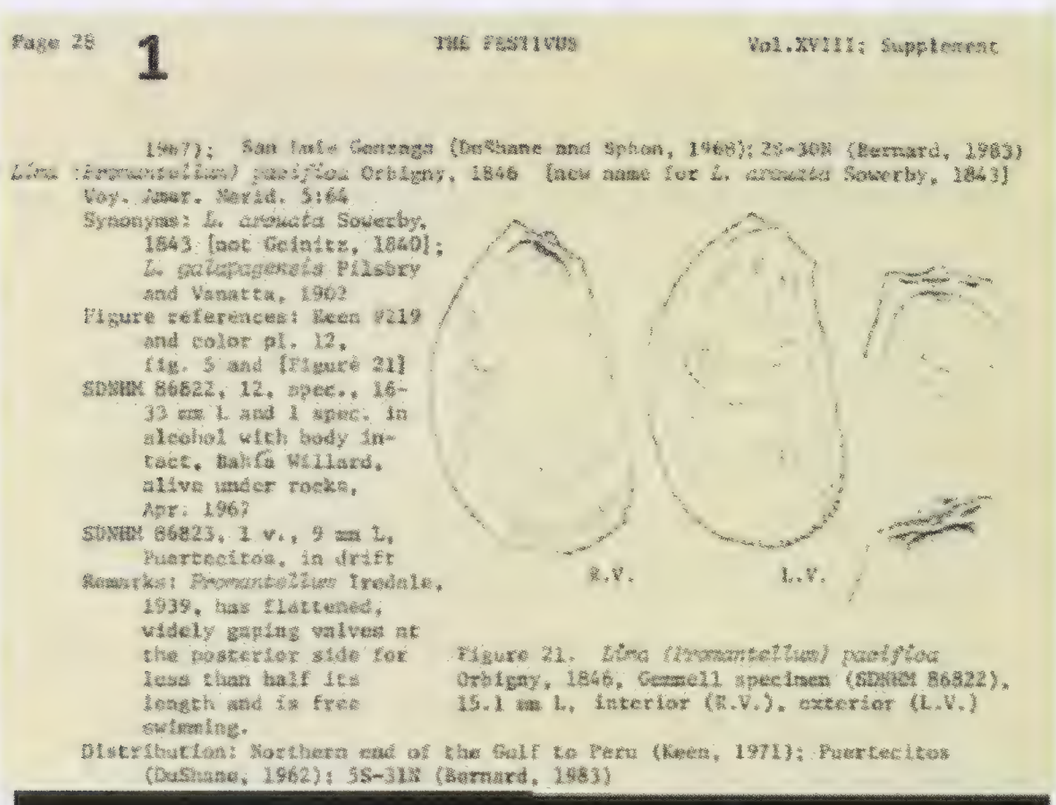
Shells of *Limaria pacifica* can reach a height of 41 mm, with a length of 24 mm. The elongate shell is ovate-oblique. Sculpture consists of 31 narrow radial ribs. There are broad anterior and posterior gapes, the anterior long and wide, the posterior long and narrow. Besides the overall shape, this gape is a very distinctive feature of the shell distinguishing it from the other Limidae in the region. Distinguishing characteristics for most of these eastern Pacific Limidae species can be found in Coan & Valentich-Scott (2012: 317-318).

Synonyms of *Limaria pacifica* are *Lima arcuata* G. B. Sowerby II, 1843, and *Lima galapagensis* Pilsbry & Vanatta, 1902.

Enjoy the images!

ACKNOWLEDGMENTS

I am very grateful to Kevin Lee and Paul Valentich-Scott for allowing me to use their marvelous photographs, and to Robert Dees for editing comments.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Page 28
THE FESTIVUS
Vol.XVIII; Supplement
1967); San Luis Gonzaga (DuShane and Sphon, 1968); 28-30N (Bernard, 1983)
Lima (Aromantellum) pacifica Orbigny, 1846 [new name for L. arcuata Sowerby, 1843]
Voy. Amer. Merid. 5:64
Synonyms: L. arcuata Sowerby, 1843 [not Gmelin, 1840]; L. galapagensis Pilsbry and Vanatta, 1902
Figure references: Keen #219 and color pl. 12, fig. 5 and [Figure 21]
SDNHM 86822, 12, spec., 16-30 mm L and 1 spec. in alcohol with body intact, Bahía Willard, alive under rocks, Apr. 1967
SDNHM 86823, 1 v., 9 mm L, Puertecitos, in drift
Remarks: Aromantellum Iredale, 1939, has flattened, widely gaping valves at the posterior side for less than half its length and is free swimming.
Distribution: Northern end of the Gulf to Peru (Keen, 1971); Puertecitos (DuShane, 1962); 5S-31N (Bernard, 1983)
R.V.
L.V.
Figure 21. Lima (Aromantellum) pacifica Orbigny, 1846, Gemmell specimen (SDNHM 86822), 15.1 mm L, interior (R.V.), exterior (L.V.)
2
3
Photos by Paul Valentich-Scott
4
5
6
7
Photos by Paul Valentich-Scott

Figure 1. Discussion and illustration of *Limaria pacifica* (Gemmell, Myers & Hertz, 1987: 28).
Figures 2-7. Syntype specimen of *Lima galapagensis*, synonym of *Limaria pacifica*. ASPN 81787, Isla Albermarle, Islas Galápagos, Ecuador; length 22 mm, height 33 mm. Photos by Paul Valentich-Scott. 2-3: right valve, exterior and interior; 4-5: left valve, exterior and interior; 6: posterior gape; 7: anterior gape.

ISSN 0738-9388

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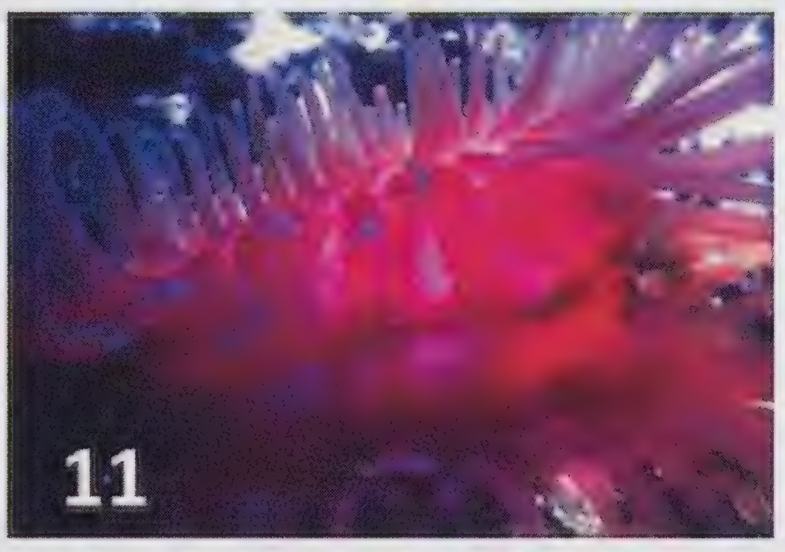

Figure 8. Living *Limaria pacifica.* Photo by Kevin Lee, November 2015, Punta la Gringa, Bahía de los Ángeles, Baja California. **Figure 9.** Coarse sand bottom nest under rock with Limaria pacifica. Photo taken 13 February 2014, at Punta la Gringa, BLA, by HB. **Figure 10.** *Limaria pacifica* on underside of rock, with *Arcopsis solida* (G. B. Sowerby I, 1833) attached. Photo taken 13 October 2014, at Punta la Gringa, BLA, by HB. **Figures 11-13.** Close-up of mantle and tentacles of *Limaria pacifica*. Photos taken *in situ*, 30 feet deep, at Las Arenas, Baja California Sur (west of La Paz), 6 June 1985, by HB.

ISSN 0738-9388

Volume: 55 THE FESTIVUS ISSUE 3

Range Extension and Size Range of *Terebra pedroana* Dall, 1908

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Percy A. Morris, 1966, gave the geographical range of *Terebra pedroana* Dall, 1908, from Redondo Beach, California, to Mexico, with a height slightly more than 1 inch (1 inch = 25.4 mm). In his acknowledgements for A Field Guide to Pacific Coast Shells, Percy Morris wrote, "John Q. Burch of Los Angeles, well known to all West Coast collectors, has provided a number of specimens and much information." John Burch (1894-1974) and his wife, Rose (1897-1989), were noted for the many specimens they collected/dredged off Redondo Beach. Having myself collected many *T. pedroana* off Redondo Beach, it's likely John and Rose also found them there and that John told Percy Morris so, providing The Field Guide's northern range for the species. James H. McLean, 1978, gave the range of *T. pedroana* from San Pedro, CA, to southern Baja California, with a height of 30 - 45 mm. David P. Berschauer and Roger N. Clark, 2018, gave the range from San Pedro, CA, to Baja California Sur, Mexico, with a size to 45 mm. Though still emotionally attached to a name I've used for over 50 years, I note that WORMS, the World Register of Marine Species, as of 24 Jan 2020, has given the accepted name of *pedroana* as *Neoterebra pedroana* (Dall, 1908). Wikipedia, using WORMS' new name, currently records the northern range of *pedroana* to Santa Monica, CA, with an adult size from 40 to 61 mm.

Though no longer in my collection I found four dead *T. pedroana* in 1976 while diving off Manhattan Beach, CA, just north of Hermosa Beach. In 1978, I collected three dead *T. pedroana*, including 49.2 and 49.5 mm specimens, at 60 feet on the Hermosa artificial reef, one mile off Hermosa Beach, CA, just north of Redondo Beach. Diving with Paul Stillians and Kevin May in July 1977, near Tajiguas Beach, CA, about 25 miles west of (above) Santa Barbara, my dive notes record that Paul observed a live *T. pedroana* (on this same two-dive day I observed 100s of closely gathered *Altimitra idae* Melville, 1893, including several over 60 mm, laying eggs on a low rock ledge adjacent to sand). During a recent conversation, David Schroeder confirmed that he had also observed and collected live *T. pedroana* near Tajiguas Beach, about 25 miles SE of Point Conception. David of Lompoc, CA, was an active shell diver in the 1970s and 80s and dove with Jim Cordy. Jim (1932-2018), had nine 1987 Lost Operculum Club ("LOC") records. I met David in July 1979, while diving at San Carlos, Mexico. Based on the above, it would appear that *T. pedroana* has a northern range to at least Point Conception, CA.

The list below records the height of 88 *Terebra pedroana* collected from Hermosa Beach, CA, south to San Pedro, CA, during the years of 1976 through 1980. Most of the shells were collected north of San Pedro, CA, off the Palos Verdes Peninsula and at Redondo Beach. All the shells were collected dead, with no preference given to size, while diving at 6 to 20 meters by the author. The largest specimen, 61.2 mm, collected off the Palos Verdes Peninsula in 1979, was the 1980 and 1987 LOC record and the 1997 through at least 2016 Registry of World Record Size Shells record. A prior short-lived LOC record at 56.8 mm, was collected by the author near Flat Rock, off the northern

ISSN 0738-9388

Palos Verdes Peninsula in 1977. The previous longtime LOC record was a 50 mm specimen, collected at Newport Bay, CA, prior to March 1950, that was held and likely collected by Morris Carruthers. Morris was recorded deceased in the 1987 LOC list, where he retained ten original LOC records, registered in March 1950, with five collected at Morro Bay, CA, and two just north at Cayucos. When two shells had the same size a (2) was placed by the measurement.

Terebra pedroana Dall, 1908, size range from a sample of 88:

61.2 mm	44.9	41.1	38.0	33.2
58.9	44.8	40.9	37.4 (2)	33.1
56.8	44.7 (2)	40.8	37.3	32.8
56.7	44.1	40.7	37.2	32.6
54.8	43.7	40.6	36.3 (2)	32.1
52.9 (2)	43.5	40.3	36.0	32.0
52.1 (2)	43.2	40.1	35.9	31.8 (2)
51.5	43.0 (2)	39.9	35.7	30.5
51.1	42.8	39.6	35.5	30.0
50.6	42.7	39.0	35.2	29.3
49.5	42.5	38.8	34.6	28.4
49.2	42.3	38.6	34.0	28.3
47.2	41.8	38.5	33.9	28.0
46.2 (2)	41.3	38.3	33.6 (2)	25.8
46.1	41.2 (2)	38.2 (2)	33.5	23.8
			33.4	21.3

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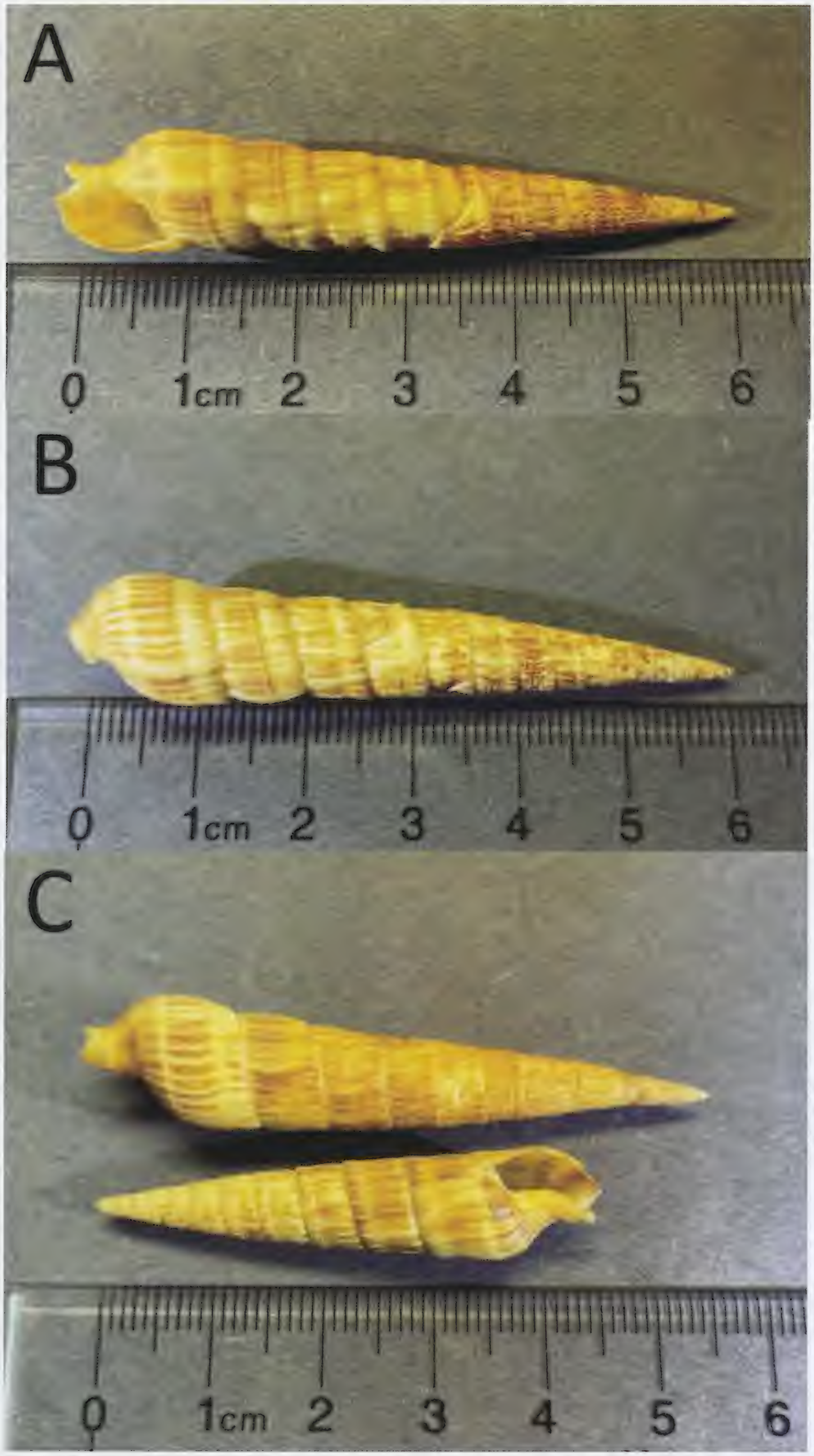

Figure 1. *Terebra pedroana* Dall, 1908. **A** = 61.2 mm, Palos Verdes, CA. **B** = 61.2 mm, Palos Verdes, CA. **C** = 56.7 mm, Palos Verdes, CA, and 44.7 mm, Redondo Beach, CA. Photos taken with an iPhone 12 by Paul Stillians adjacent to a ruler with millimeter markings.

ISSN 0738-9388

Volume: 55 THE FESTIVUS ISSUE 3

Variability in *Gradiconus maya* Petuch and Sargent, 2011

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The Maya Cone Shell, *Gradiconus maya* Petuch and Sargent, 2011, is a poorly-known species that was described from the Yucatan Peninsula of the Gulf of Mexico region, where it occurs in shallow water near coral reefs and Turtle Grass beds. Until recently, this endemic Yucatan species was relatively unknown to the malacological world, primarily due to the lack of collecting in the lagoons and shallow offshore areas along the northern and eastern coasts of the peninsula. This lack of information about a large and conspicuous endemic Mexican cone has been reversed within the past few years, as Mexican shell dealers and curio shop owners have begun to collect and accumulate large numbers of this distinctive Yucatan shell.

Recently, in a shell collector group posting on a social media website, several photographs of *G. maya* were shown that had been collected on beaches near Celestun and other areas along the Yucatan Peninsula. I received a message from the individual who collected the specimens and posted the photographs, Gilberto Naal Mora of Celestun, Yucatan State, Mexico, and he generously offered to sell me several specimens. After contacting me by telephone, he mailed me a large collection of individual specimens of *G. maya*, enough to undertake a comprehensive study of the variations in shell shape and color. Prior to obtaining this large collection, my general perception of the species was that it was a low-spired shell with a distinctive orange base color overlaid with rows of dot-like markings, resembling the specimen shown here on Plate 1, Figures A and B. This specimen also closely resembles Petuch and Sargent's holotype from Laguna de Yalahau. After studying the cones that I had purchased from Sr. Mora, I was surprised to see the wide variability of shell shape, color, and patterning, demonstrating that the species was morphologically much more variable than previously thought.

I have chosen 12 specimens of *G. maya* from my collection of Celestun specimens to illustrate here, showing the extremes in variability. Some of the forms shown on Plates 1 and 2 appear to be rare, especially the form with a white base color and distinct rows of brown dots (shown here on Plate 1, Figures A, B). Other uncommon forms include those with a brown base color (Plate 2, Figures K, L) or white with brown zigzag markings (Plate 2, Figures I, J), which resemble the color patterns seen on *Gradiconus burryae* (Clench, 1945) from the Florida Keys. Although most specimens of *G. maya* have low spires, a few individuals had high, elevated spires (Plate 2, Figures A, B) or extremely protracted, scalariform spires (Plate 2, Figures G, H). Based on the observed extreme variability of the Maya Cone shown here, it can be seen that this Yucatan endemic is the most variable member of the Gulf of Mexico *Gradiconus* species complex, which also includes *G. floridanus*, *G. burryae*, *G. mazzolii*, and *G. largillierti*.

ISSN 0738-9388

Plate 1. A, B= uncommon yellow specimen of *Gradiconus maya*, 32 mm; **C, D**= uncommon white/cream specimen of *G. maya*, 32 mm; **E, F**= very rare white color form of *G. maya* with brown horizontal bands, 36 mm, only one found among hundreds of specimens; **G, H**= common typically-patterned orange specimen of *G. maya*, 33.5 mm; **I, J**= uncommon light orange specimen with white shoulder band, 37 mm; **K, L**= white and dark yellow specimen of *G. maya* with uncommon big rectangular markings, 27 mm, markings similar to some seen in some specimens of *Gradiconus largillierti* (Kiener 1840) that were trawled in deep water off Cabo Catoche, Yucatan.

ISSN 0738-9388

Volume: 55 THE FESTIVUS ISSUE 3

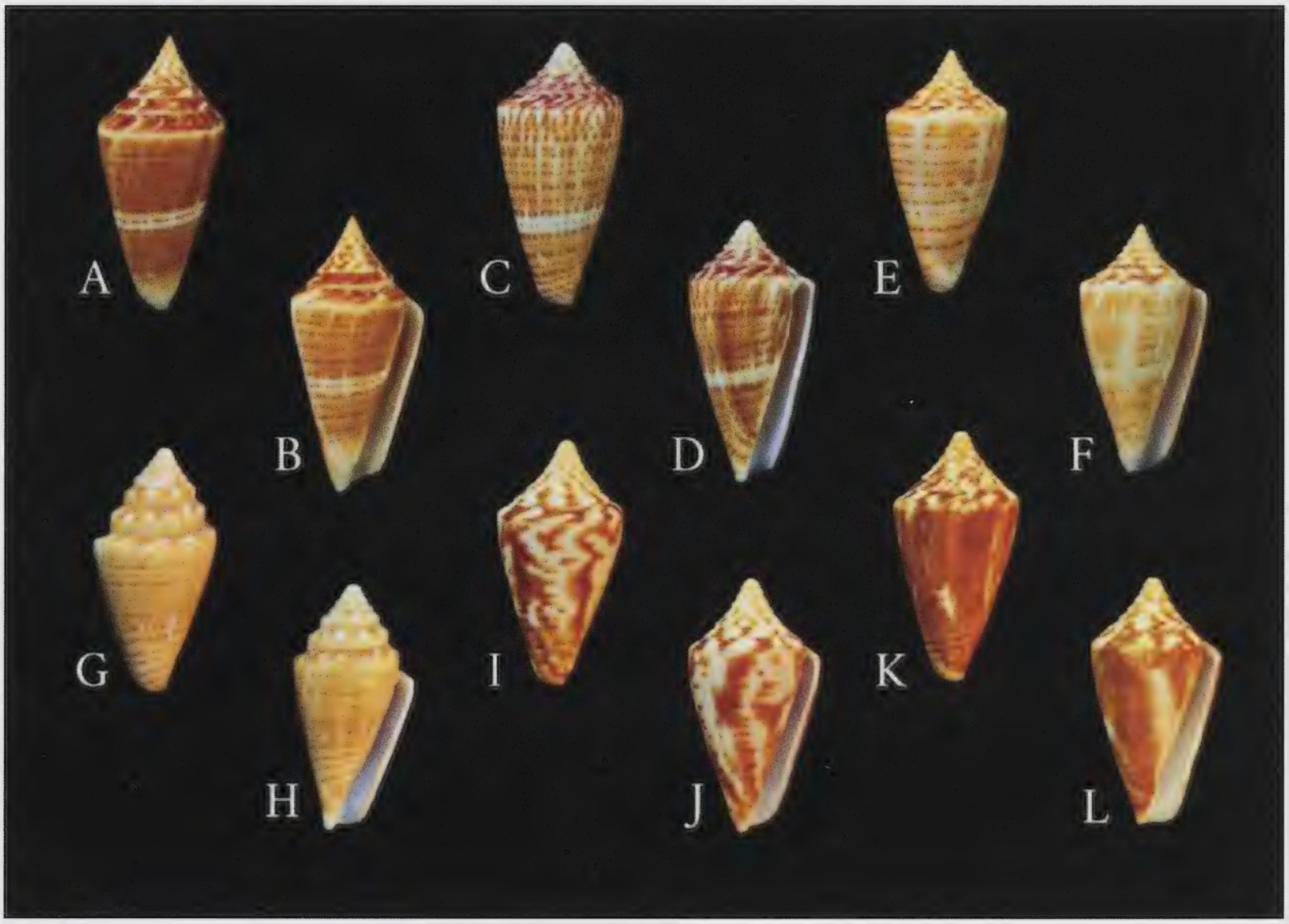

Plate 2. A, B= moderately common dark orange specimen of *G. maya* with uninterrupted white mid-body band, 39 mm; **C, D**= uncommon orange specimen of *G. maya* with abundant, horizontally-arranged dots, white mid-body band, and uniformly-arranged clustered flammules on the spire, 37 mm; **E, F**= rare white and light yellow specimen of *G. maya* with interrupted horizontal lines, and vaguely scalariform, almost smooth spire, 33 mm, only two almost identical specimens of this form were seen among hundreds; **G, H**= very common orange freak form of *G. maya* with an extremely scalariform spire, 35.5 mm, several were seen with this particular mutation, no scars have been observed in the spires of most of these common freak specimens, which might allude to a common genetic mutation among specimens of this species being the cause of these aberrant shells; **I, J**= uncommon white specimen of *G. maya* with amorphous brown markings, 34 mm, not a particularly rare form of this species, but not nearly as common as typically-patterned orange specimens; **K, L**= very uncommon almost solid brown specimen of *G. maya,* 38 mm, only a handful like this one were seen among hundreds.

ISSN 0738-9388

The Passing of a Best Friend - Paul Kanner

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I say "a" best friend rather than simply "best friend" in consideration of the so many others who have also been close, long-standing friends with Paul. It's not easy to put into words the tangible and emotional factors integral to a best friend relationship but that wasn't difficult with Paul and me. Neither of us were generally at a loss for words.

Paul was a straight shooter, putting his thoughts and emotions (for the most part) on the table in a rational and well contemplated fashion. And while he was conservative in his political and economic beliefs (though less so with social issues), he would never be confrontational with those who thought differently than he did.

Of the innumerable memories of Paul as a best friend, three come quickly to mind. Did you know Paul was a junkie? As a junk food junkie myself all I can say is it takes one to know one. This was quite clear on our second dive trip just after arriving in Rangiroa from the isolated Tikehau in the Tuamotus. After ten days of living on local pension food, we were directed to a market up the road, and so we hitched a ride and off we went. It was comical, with both of us practically lunging when we spotted what looked like the last two bags of Crunchy Cheetos in all of French Polynesia. I'll never forget the look of total satisfaction Paul had as we sat together with Rangiroa's beautiful lagoon in full view, bags of Cheetos open and munching away happily. From that point on, over the many trips that followed, there were no holds barred on junk food--with Paul's big bags of See's Candies suckers and ever-present family packs of Red Vines!

Most know Paul was an accomplished diver and collector, with a specific focus on species found in California coastal waters. Over our 15 years as dive partners, Paul was always an enthusiastic collector, finding species of note in Honduras, the Marquesas, Hawaii, New Caledonia, and Western Australia. However, it was during a second visit to Easter Island in 2006 that Paul's most notable find occurred. Assured by Michell Garcia that all of us would find *Cypraea caputdraconis*, *C. englerti*, and *C. cernica leforti*, none of us had expectations of finding the rare and elusive *Cribrarula garciai*. That's not to say that on our night dives we didn't give it our all, as Michell revealed that *C. garciai* inhabited crevices in lava tubes and as such, could only be found at night in complete darkness. Paul proved otherwise! Ascending on the float line under Paul, I noticed a flash of orange in his collecting bottle and as I caught up to him, I could clearly see that Paul had done what had never been done before, or to this day--collecting on a day dive not one, but a pair of magnificent *C. garciai*. A deal was struck, and whenever I look at those two shells in my collection, I remember the excitement and jubilation we shared that day.

Last but not least is a memorable instance of how Paul, in pursuit of his interests as an amateur marine biologist, would literally take any "bull by the horns". With his hands conditioned from a lifetime of work as a contractor, Paul would often handle stuff with his bare hands that most would

ISSN 0738-9388

not ever consider touching. So early on a trip to the Marquesas, Paul didn't think much of it when he felt a slight twinge from a *Conus obscurus* he was holding. But, as the trip progressed and we started to find *Conus bullatus*, Paul's scientific inquisitiveness got the best of him. In his room after a night dive, he picked up, bare handed, a *C. bullatus* with an actively extended proboscis and was immediately stung by this much larger and more toxic fish-eating species. He lived, but lesson learned--don't play with nature unknowingly as it took a good three months before Paul's hand was pain free. I would occasionally chide him about the *C. bullatus* incident and I can say that being the easy-going, good-natured guy that Paul was (most of the time) he would always respond with a smile and tell me where I should go. A Best Friend gone now--but never forgotten.

Figures 1-4. Left is a photo of Paul and DeAnna Kanner at home in October 2021 (photo by David P. Berschauer). Right: top is Paul Kanner and his friend Andy Saxon lobster fishing off Los Angeles, California (photo from Paul's Facebook page); middle image is Paul Kanner and friends Carl Ehrlich, Marty Beals, and Harry Bedell going diving in Nuku-Hiva, French Polynesia (photo from Paul's Facebook page); bottom is Paul Kanner diving off Easter Island with his find of the trip - a pair of *Cribrarula garciai* (photo courtesy of Harry Bedell).

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Paul Herman Kanner 1934-2023

Harry Bedell
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Paul Herman Kanner had the laid-back charm of an old-time movie star. For his family and his friends he was our everyman - someone who connected people with his warmth and kindness. Paul had a profoundly gentle strength that many relied upon. His quiet passing at home with loved ones in his shell room on July 21st has left a hole in many hearts.

Paul's early childhood roots included many summers in Florida and where his father gifted him his first seashell which I'm almost certain Paul still had in his collection. In Southern California in the 1940's he became part of a long tradition of divers, fisherman and undersea hunters. Paul was a waterman with love and respect for the sea. He could read the bite of a Halibut or a Calico Bass, free-dive to dislodge a snagged anchor, or fix a broken bilge pump threatening to ruin a dive trip. He knew ocean currents, could read a coastline and chart hidden dive spots likely to produce game fish or awesome seashells.

Paul was a Mechanical Plumbing Contractor and moonlighted weekends as a dive boat Captain. If you can find an old Hollywood Yellow Pages look for the photo of Paul with his big movie star smile in an ad for O'Keefe Plumbing. He had stories of contracting for reclusive Hollywood stars like Elizabeth Taylor and he once recounted working for Walt Disney on the famous Submarine Ride when it needed major hydraulic repairs - a ride that sparked my own early interest in diving. Paul talked often about the values of the Tradesman: To learn through apprenticeship and to do the job right and with integrity. He lived those values in everything.

Paul saw the world and the world saw him. His shell-diving expeditions included the Marquesas, the Tuamotus, Australia, The Solomons, Easter Island, New Caledonia, Belize, Panama, and The Sea of Cortez. His diving buddies were legendary. Paul began his travels in the Army where he was stationed part of the time in Japan, a culture that tempered a bit of the young renegade in him. As crew on a long-range crossing to the Galapagos, he was initiated into the "Court of King Neptune" as a "Shellback" after the requisite short swim across the Equator. Of the many trips I made with Paul there was one I remember most fondly where we explored unpaved tracks on Easter Island perched over 360 degree ocean vistas and volcanic slopes shadowed by giant Moai. We were at the center of the world.

The reefs and offshore islands of Southern California were Paul's backyard. He dove the Horseshoe, Begg Rock, and Camby's. He collected and was an expert in all manner of California mollusks, their biology and habitats. And he shared his knowledge with other divers, collectors and scientists. Paul modeled himself like a scientist driven by curiosity and keen observation skills. His home-built saltwater aquarium with local California species was legendary. Shells he collected like *Amphissa versicolor lineata* ended up in museums or as samples informing scientific studies. Other shells of Paul's were illustrated in books like The Cone Shells of the Marquesas or on the cover of Cowries by Felix Lorenz. He denied it, but Paul was a great photographer with an eye for composition and small details and he got tremendous joy out of sharing his photos and stories with others.

Most of all, Paul appreciated natural history. The obscure life habits of lowly snails! Colors, textures and patterns. A rugged guy with hands like catchers' mitts, Paul was drawn to things that were beautiful and sublime. Unusual *Bursidae* and graceful strombs. Colorful and rare *Cymatium* and *Pectinidae*. Rhode Island

ISSN 0738-9388

Butterflies. Fish of the California Kelp Forests. He loved sitting outside and admiring his wife DeAnna's spectacular gardens. And he loved Bluegrass music and listening to his son Kevin play Jazz.

Certain things were a given on any shell trip with Paul. First, after a week, he would get terribly homesick for DeAnna, his kids, grandkids and his dogs Madison and Chuck—justly earning him the nickname Ole' Misty Eyes. He would invariably pull it together and proceed to find super-rare shells like two(!) Easter Island *Cypraea garciai* or a *Conus pseudimperialis* (then a newly named species) that a discerning rat absconded with one night in Nuku-Hiva after left unguarded in his collecting tray. Celebrations would always follow with a Pisco Sour and another tattoo of a shark or manta-ray. Finally, the shell deities would extract their revenge and Paul would be stung by an exotic marine creature like a *Diadema* urchin or some very poisonous cone. "Hey guys! The *bullatus* just spit up a tiny fish … E*xpletive!"*

Paul's shell room and shell garage were places of camaraderie. Drawers of cool stuff to dig through. Stories to tell and retell about great times spent exploring together. Arguments to be had over nomenclature changes and good rum to drink. And awesome self-collected shells to admire: *Cancellaria cooperi* (Paul's favorite), *Nodipecten magnificus*, outrageous *Lambis pilsbryi*, fiery red *spadicea* from a secret shipwreck, Baja *Spondylus* and all those spectacular California *Muricidae*.

There were also shells in various states of cleaning. Paul LOVED cleaning shells. Dental picks, Dremels, home-made gadgets and magnifiers … all to call forth natural beauty. Like being lost in his wood carving, he could clean shells (both his and yours) for hours. On the other hand, Paul's shell labels had more in common with most doctors' prescriptions. And he was certainly clumsy with rare shells - like his (no longer) WRS *Bursa californica* or stellar *Conus gauguini* with black markings and hints of orange. "Check it out!" Clunk. "E*xpletive*!"

Paul told me two days before his passing that it was never really about the shells but about the friendships. Each shell a time and a place he came together with people he cherished - at a COA convention, an SDSC auction, on Facebook or together with his buddies on a boat in some far-flung island paradise. Paul was a stand-up friend and just a really, really good man. Ask a surfer what the term "Old-School" means to them next time you're in Malibu, a place Paul often rode his bike to as a teenager to go fishing and free-diving. They'll likely tell you it's somebody who's style is classic and elegant … always in flow with the ocean. That was Paul. He graced us all with his friendship.

Favartia kanneri Houart, 2021, Galapagos Islands, Ecuador. (Photo of the holotype MNHN-IM-2000-36519, courtesy of Roland Houart)

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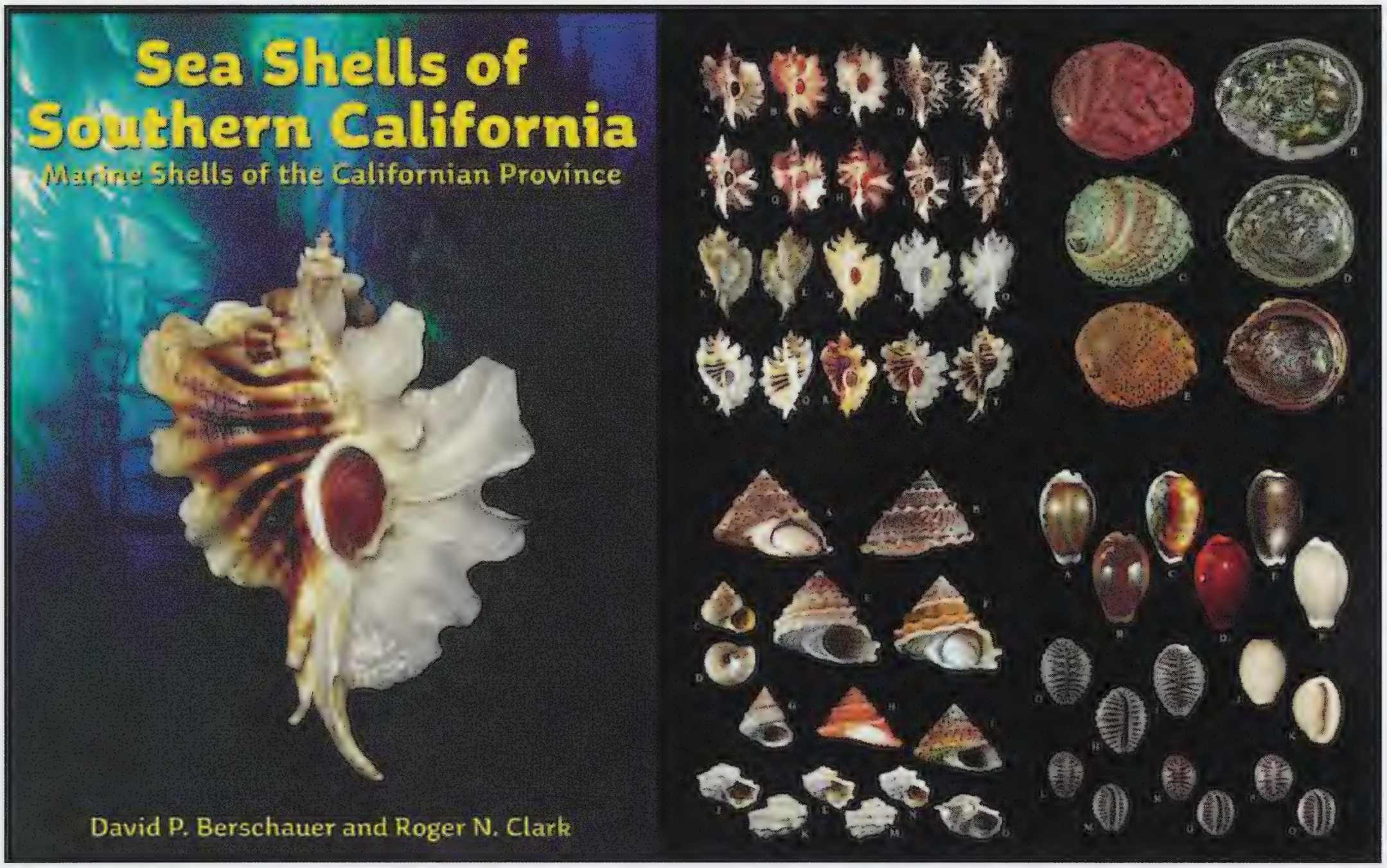
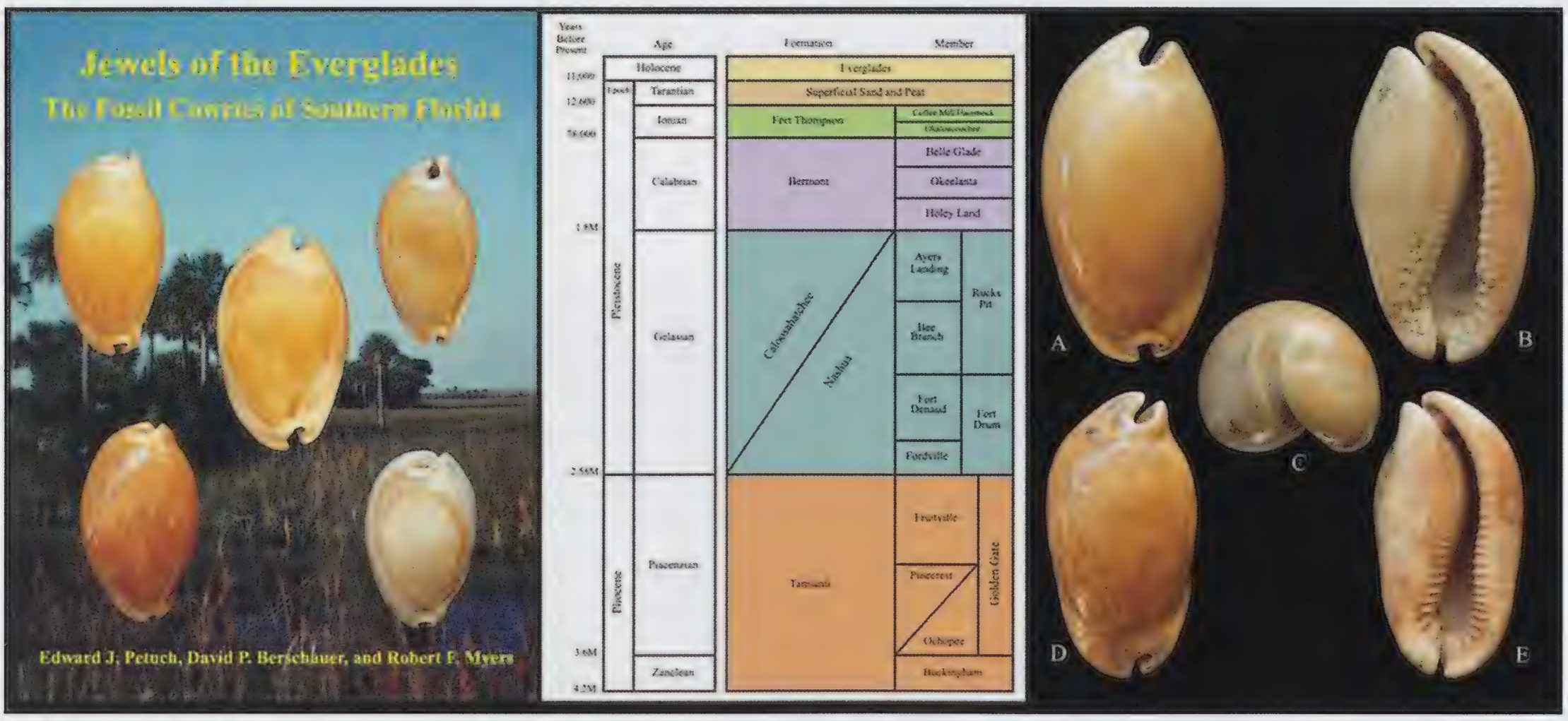


Back by popular demand in a third printing. This book presents a biogeographical overview and iconography of the regional molluscan fauna of the California Marine Province, covering 351 species of mollusks illustrated on 58 full page color plates. Copies are available in softbound ($35) and hardbound collector's edition ($50) plus tax and shipping costs.



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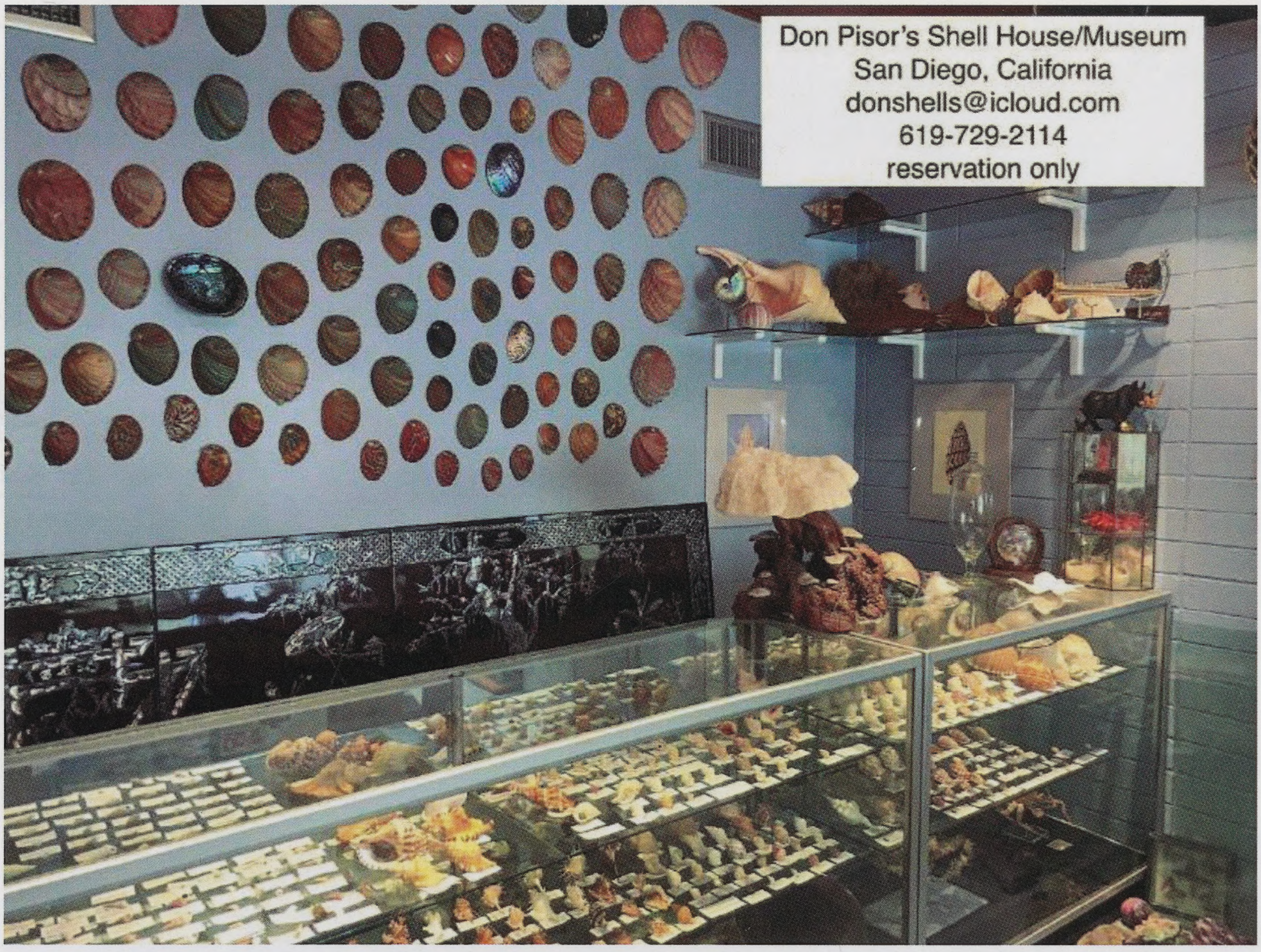

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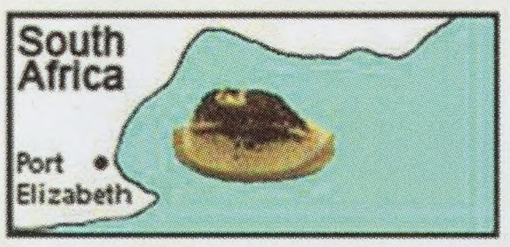

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Volume: 55 THE FESTIVUS ISSUE 3

Back cover: *Fasciolaria haleyi* Berschauer & Petuch, new species, paratype No. 2, length 148.9 mm, superimposed over a beach scene from Cancun, Mexico. (Cover artistic credit: Rex Stilwill).

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